

CAI
MS61

-57N56

128

Government
Publications



CANADA

DEPARTMENT OF MINES AND TECHNICAL SURVEYS

MINES BRANCH
INDUSTRIAL MINERALS DIVISION

INDUSTRIAL WATER RESOURCES OF CANADA

WATER SURVEY REPORT NO. 8

MACKENZIE RIVER AND YUKON RIVER DRAINAGE BASINS IN CANADA, 1952-53

3 1761 11767571 0



BY

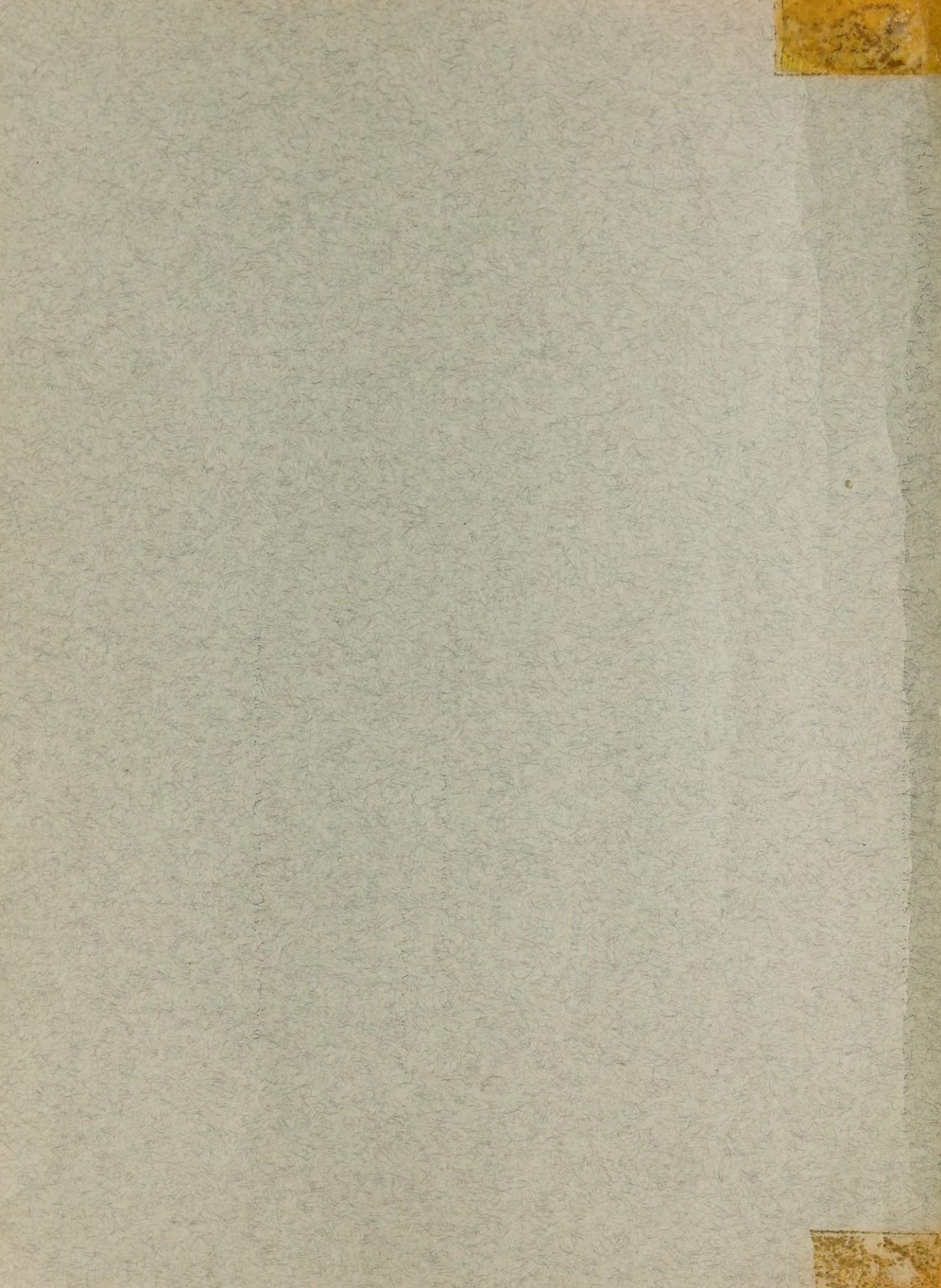
J. F. J. THOMAS

EDMOND CLOUTIER, C.M.G., O.A., D.S.P.
QUEEN'S PRINTER AND CONTROLLER OF STATIONERY
OTTAWA, 1957

Price \$1.00

No. 856

LIBRARY
OF THE
GREAT LAKES INSTITUTE
UNIVERSITY OF TORONTO





CANADA
DEPARTMENT OF MINES AND TECHNICAL SURVEYS

MINES BRANCH
INDUSTRIAL MINERALS DIVISION

INDUSTRIAL WATER RESOURCES OF CANADA

WATER SURVEY REPORT NO. 8

MACKENZIE RIVER AND YUKON RIVER DRAINAGE BASINS IN CANADA, 1952-53

BY
J. F. J. THOMAS



Price \$1.00

928-2,500-1957

No. 856



Digitized by the Internet Archive
in 2023 with funding from
University of Toronto

<https://archive.org/details/31761117675710>

CONTENTS

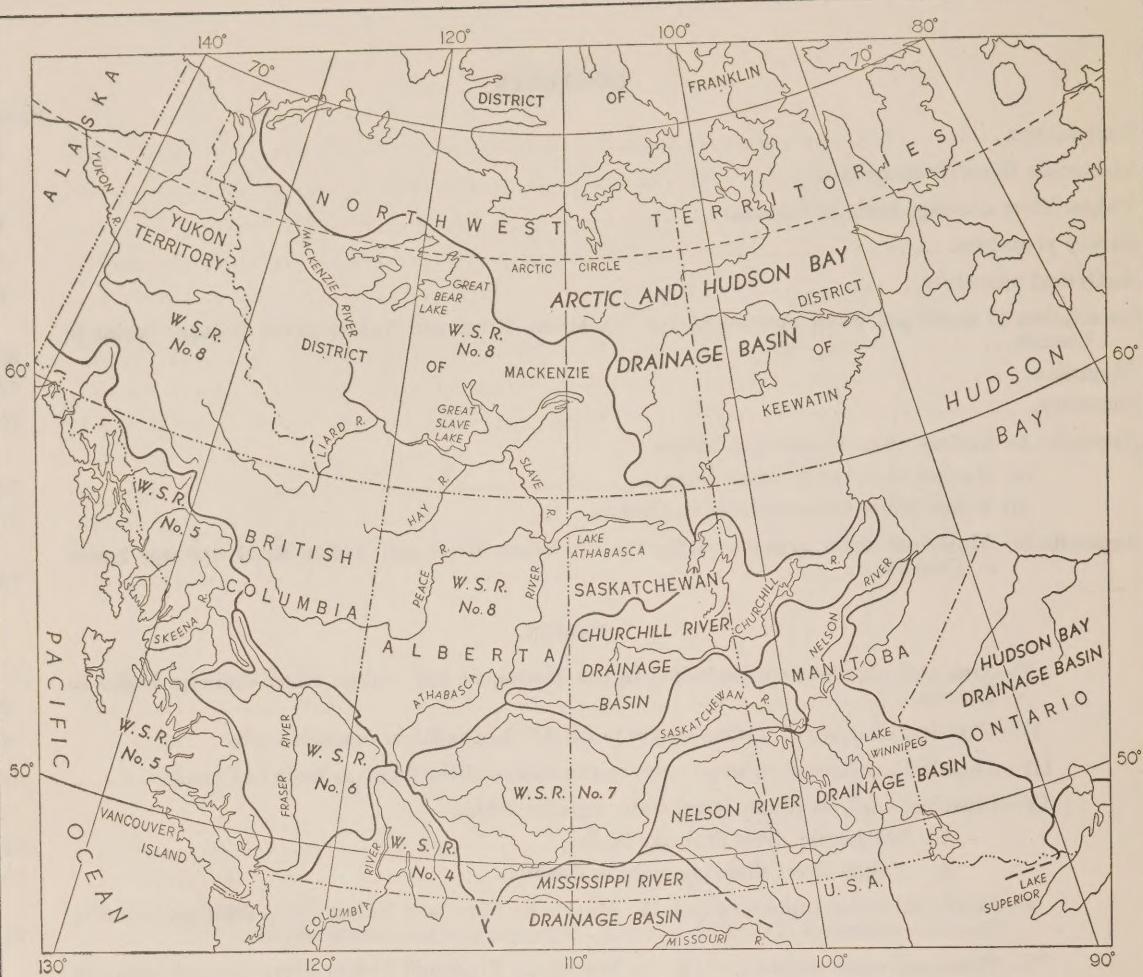
	PAGE
Introduction.....	5
Mackenzie River drainage basin.....	7
Yukon River drainage basin in Canada.....	8
Survey procedure.....	8
Analytical procedure.....	9
Description of municipal water systems in the Mackenzie River and Yukon River drainage basins in Canada.....	56
Discussion.....	74
Summary.....	75
Appendix A—Surface water sampling locations	
(a) Mackenzie River drainage basin.....	76
(b) Yukon River drainage basin in Canada.....	77
Appendix B—Municipal water systems within the Mackenzie River and Yukon River drainage basins in Canada.....	78

TABLES

I—Area and population distribution in the Mackenzie and Yukon River drainage basins in Canada.....	6
II—Chemical analyses of surface waters in the Mackenzie River drainage basin.....	14
III—Chemical analyses of surface waters in the Yukon River drainage basin in Canada.....	54
IV—Chemical analyses of municipal water supplies within—	
A. Mackenzie River drainage basin.....	62
B. Yukon River drainage basin in Canada.....	72
V—Municipal water supplies within the Mackenzie River and Yukon River drainage basins in Canada—summary of data on systems, treatment and population served.....	73
VI—Municipal water supplies within the Mackenzie River and Yukon River drainage basins in Canada—summary of data on municipal water hardness.....	73

FIGURES

Fig. 1. Map showing major drainage areas studied and under study in western Canada.....	facing	5
Fig. 2. Map showing the location of surface water sampling stations and municipal water supplies..(in pocket)		
Fig. 3. Chart showing change in water hardness along the Mackenzie River system.....	10	
Fig. 4. Relationship between mineral content and river flow, Athabasca River at Athabasca, Alta.....	11	
Fig. 5. Seasonal variation in chemical quality, Mackenzie River at Fort Simpson, N.W.T.....	12	
Fig. 6. Relationship between mineral content and river flow, Liard River at Watson Lake, Y.T.....	13	



LEGEND

- W.S.R. No. 4** Water Survey Report No. 4, Columbia River Drainage Basin; Mines Branch Rept. No. 838, published 1953
- W.S.R. No. 5** Water Survey Report No. 5, Skeena River Drainage Basin, Vancouver Island, and Coastal Areas of British Columbia; Mines Branch Rept. No. 839, published 1953
- W.S.R. No. 6** Water Survey Report No. 6, Fraser River Drainage Basin; Mines Branch Rept. No. 842, published 1954
- W.S.R. No. 7** Water Survey Report No. 7, Saskatchewan River Drainage Basin; Mines Branch Rept. No. 849, published 1956
- W.S.R. No. 8** Water Survey Report No. 8, Mackenzie and Yukon Rivers Drainage Basins in Canada; Mines Branch Report No. 856, published 1957

SCALE OF MILES

100 0 100 200 300 400 500.

G.S.C.

FIGURE 1. MAP SHOWING DRAINAGE BASINS UNDER STUDY IN WESTERN CANADA

INDUSTRIAL WATER RESOURCES OF CANADA

Chemical Quality of Surface and Municipal Water Supplies in the Mackenzie River and Yukon River Drainage Basins in Canada, 1952-53

INTRODUCTION

This report, the eighth in the series on the chemical quality of surface and municipal waters available for industrial and domestic use in Canada, covers the large area drained by the Mackenzie and Yukon Rivers and their tributaries.

Water Survey Report No. 1¹ outlines the aim, scope and procedure of the country-wide survey begun in 1947 and discusses with the assistance of graphs and tables the interpretation of analytical results to be recorded in the subsequent reports.

Water Survey Reports Nos. 2² and 3³ give in detail the results of studies on water quality in the drainage basins of the Ottawa River, and of the Upper St. Lawrence River-Central Great Lakes, respectively.

Figure 1 shows the area covered by this report and its relationship to other major drainage areas or basins in western Canada. It also shows the basins already reported in Water Survey Reports Nos. 4 to 7 inclusive. Similar reports for the remaining basins shown in Figure 1 are in progress.

Table I tabulates the approximate area of the drainage basins shown in Figure 1, and the ratios of population (1951 Census) and area in these basins to each other and to all of Canada.

The drainage basins covered by this report, except for the most southerly part of the Mackenzie River basin (Peace and Athabasca River basins in northern Alberta) are very sparsely settled, generally inaccessible by road and, at this date, of minor industrial importance. Therefore water quality studies were limited compared with studies carried out in many other drainage basins. In recent years appreciation of the natural resources of this large area of Canada is rapidly opening up the country, especially to mining and hydro-electric development. As a result there is an increasing need for knowledge on water resources and it is probable that more detailed studies on water quality, at least in certain parts of these river basins, may be required in the future.

The method of presentation of data in this report is essentially similar to that of previous reports of the series, no attempt being made to discuss in detail all the information recorded during the survey, although some statistics on water use and quality are presented and briefly discussed.

Tables II and III report in detail the analytical results on surface waters collected in 1952-53 and Figure 2 (in pocket) shows the location of the sampling points, listed alphabetically in Appendix A.

Figure 3 shows graphically the variation in water hardness in the Mackenzie River system as determined by these studies.

Figures 4, 5 and 6 show the variation found in chemical quality of the waters of the Athabasca River at Athabasca, Alta., Mackenzie River at Fort Simpson, Northwest Territories and the Liard River at Watson Lake, Yukon respectively. These figures illustrate the type of information that can be obtained from data supplied in Tables II and III.

Table IV reports the chemical quality of the waters supplied by organized systems to municipalities in both basins; these systems are listed alphabetically in Appendix B and their locations are shown on Figure 2 in such a manner as to classify them as to water hardness.

Table V summarizes the available information on source of water, treatment of water and population served in 1951 by organized systems and Table VI presents statistics on these systems with regard to water hardness and population served with different types of water.

A description of the few organized water systems operating up to 1952 in the basins is given under the headings, *population served, ownership of system, source of water, treatment of water, storage capacity of the system, consumption of water and industrial use of the water*.

Survey studies in this relatively inaccessible area of Canada were greatly facilitated by the cooperation of federal, provincial and municipal officials who by correspondence or personal contact with engineers of the department, supplied samples of the waters and information on the systems.

The assistance of the Department of Northern Affairs and National Resources, particularly district engineers, E. P. Collier and W. C. Warren, in supplying the writer with data on river and lake stage and river discharge, is gratefully acknowledged.

Acquisition of information on many of the waters in the far northern parts of the basins was made possible through the cooperation of members of the RCMP who collected and forwarded the samples.

Industrial Water Resources of Canada, Department of Mines and Technical Surveys, Ottawa, Ontario.

¹ Water Survey Report No. 1. Scope, Procedure and Interpretation of Survey Studies. Mines Branch Report No. 833, 1952.

² Water Survey Report No. 2. Ottawa River Drainage Basin. Mines Branch Report No. 834, 1952.

³ Water Survey Report No. 3. Upper St. Lawrence River-Central Great Lakes Drainage Basin in Canada. Mines Branch Report No. 837, 1954.

TABLE I

Area and Population Distribution in Mackenzie and Yukon River Drainage Basins

Drainage basins	Approximate area drained ^a (square miles)						Per cent of total provincial or territorial area drained						Estimated population in hundreds in basin areas (1951 Census)						Per cent of total provincial or territorial population in basin areas (1951 Census)			
	Y.T.	N.W.T.	B.C.	Alta.	Sask.	Total	Y.T.	N.W.T.	B.C.	Alta.	Sask.	Y.T.	N.W.T.	B.C.	Alta.	Sask.	Total	Y.T.	N.W.T.	B.C.	Alta.	Sask.
Yukon River in Canada	120,500	—	8,500	—	—	129,000	63.2	—	2.3	—	—	88.0	—	0	—	—	88.0	96.7	—	—	—	—
Mackenzie River.....	68,260	298,770	116,000	162,855	50,815	696,700	33.0	22.9	31.6	63.8	20.2	2.3	97.9d	138.0	1,180.9	11.1	1,430.2	2.6	61.2	1.2	12.6	0.1
Coastal Arctic.....	7,246	264,900	—	—	272,146	3.5	20.3	—	—	—	0.3	8.4 ^e	—	—	—	—	8.7	0.3	5.3	—	—	—
Archipelago ^b	—	541,083	—	—	541,083	—	41.5	—	—	—	—	34.3f	—	—	—	—	34.3	—	21.4	—	—	—
Hudson Bay.....	—	200,150	—	—	2,105	202,255	—	15.3	—	—	8.4	—	19.4g	—	—	0	19.4	—	12.1	—	—	—
Coastal Pacific.....	11,070	—	89,260 ^c	—	—	100,330	5.3	—	24.3	—	—	0.3	—	2,631.1	—	—	2,531.4	0.3	—	21.7	—	—
Total.....	207,076	1,304,903	366,255	255,285	251,700	—	100.0	100.0	58.2	63.8	28.6	91.0 ^d	160.0	11,652.0	9,395.4	8,317.3	4,112.0	100.0	100.0	22.9	12.6	0.1
Per cent of Total, Canada.....	5.4	33.9	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—

^a Includes fresh water.^b District of Franklin except for part on mainland.^c Includes Vancouver Island and other coastal islands.^d About 80% White, 39% Indian, 11% Eskimo.^e Only about 5% White, remainder Eskimo.^f About 6% White, remainder Eskimo.^g About 7% White, remainder Eskimo.^h About 5% White, remainder Eskimo.

THE MACKENZIE RIVER DRAINAGE BASIN

The Mackenzie River system drains about 696,700 square miles of Canada, almost 43 per cent of which lies in the Northwest Territories.

It drains the following proportions of adjacent provinces:

Yukon Territory.....	33%
British Columbia.....	32%
Alberta.....	64%
Saskatchewan.....	20%
Northwest Territories (exclusive of the northern archipelago).....	39%

The river, discovered by Alexander Mackenzie in 1789, forms one of the eight great river systems of the world and in North America is exceeded only by the Mississippi River system.

The drainage area and length of the Mackenzie River system are slightly greater than those of the St. Lawrence River-Great Lakes system, extending 2,635 miles in length from the mouth of the Mackenzie River in Northwest Territories, to the headwaters of the Finlay River in British Columbia. This large basin covers an area of about 16 degrees of latitude by 36 degrees of longitude, extending about 1,350 miles north to south, and varying in width from 900 miles near its centre to 100 miles near the Mackenzie River mouth.

A detailed description of the basin is given in "The Mackenzie River Basin" by Charles Camsell and Wyatt Malcolm, Memoir 108, of the Geological Survey of Canada, 1919. Much of the geological data that follow have been extracted from this report.

The Mackenzie River proper is only the northern portion of the system, about 1,000 miles in length from Great Slave Lake to the Arctic Ocean. At its source in Great Slave Lake the river is 7 to 8 miles wide, but overall has an average width of 1 mile with a gradient of 6 inches to the mile and an average flow of 500,000 cu. ft. per second. It is navigable throughout its length. South of Great Slave Lake, the Great Slave River, still part of the system, is navigable to Fort Smith, an additional 200 miles.

The entire drainage area is a large basin, its western side dipping steeply northeast and its eastern side more gently westward to a central depression, the whole tilted with a long, easy slope (2 feet to the mile) northward to the Arctic Ocean.

The eastern side of the basin lies in the Canadian Shield which extends northeast from the west end of Lake Athabasca along the valley of the Slave River to Great Slave Lake, then some 800 miles to MacTavish Bay on Great Bear Lake and then outside the basin to the Arctic Ocean. This Precambrian region varies from 80 to 250 miles wide in the basin and is made up of crystalline or metamorphic rocks. In the south, the Shield merges gradually into the Central Plains area of flat-lying Palaeozoic, sedimentary rocks, but elsewhere there is a well-defined line that occurs as an escarpment north of Great Slave Lake. North of Great Bear Lake the Shield becomes lake country, the lakes being usually shallow rock basins with smooth rocky shores and few sand beaches. Rivers of the Shield have no defined valleys or graded profiles but show level stretches followed by rapids and falls; hence their importance for future water power development. The few hills rising above the Shield are never more than 1,000 feet in elevation.

There is little soil within the Shield portion of the basin although in some areas there are deposits of glacial drift or boulder clay. The area is wooded except for the extreme eastern edge and a portion lying north of the eastern end of Great Slave Lake in the basins of Clinton, Alymer and MacKay Lakes.

The western portion of the drainage basin lies in the Cordilleran region, an area varying from 20 to 200 miles wide. A definite break occurs between this area and the Central Plains region, crossing Peace River about Hudson Hope and Liard River at 125 degrees latitude. Up to this point the Cordilleran region is known as the Rocky Mountains. Northwest from the Liard River the area is known as the Mackenzie Mountains. This range touches the Mackenzie River near the mouth of the Nahanni River then follows the Mackenzie north and west around the Peel River basin and dies out at the headwaters of the Peel. From here a lower range known as the Richardson Mountains continues to the Arctic Ocean.

Several rivers of the Mackenzie River system, notably Peace and Liard Rivers, cut through the mountain ranges with headwaters on the western plateau in northern British Columbia and Yukon Territory. The Peace River flows in a wide valley at maximum elevation of about 2,000 feet through the Rocky Mountains. Such major tributary rivers as the Nahanni, Root, Gravel, Carcajou, Arctic Red and Peel rise in the Mackenzie Mountains and have relatively steep gradients to the Mackenzie. The Peel River flows at an elevation some 1,200 feet lower than the Bell River, a tributary of the Yukon River, on the other side of the mountain range.

Between the Cordilleran region and the Canadian Shield lies the Central Plains area. In this broad, level and forested plain flow the Mackenzie River and its continuing tributaries, the Slave, Athabasca, etc. This lowland area varies in width from 420 miles at Fort Vermilion to 200 miles at latitude 63 degrees. Here the river gradients are very low, the flow is slow, and there are extensive areas of lake and muskeg. In the southern

part of the basin the plain is, in reality, a plateau sloping northeastward and bounded by a series of escarpments facing a lowland extending to the sea; the plateau reaches to about the northern boundary of Alberta. A somewhat similar plateau occurs again in the Peel River basin and elsewhere several irregular hills or plateaux break the lowland regions.

The Mackenzie River system includes several large lakes besides the major tributary rivers, among which are Great Bear Lake, 12,000 square miles, Great Slave Lake, 11,170 square miles and Lake Athabasca, 3,058 square miles in area. The size of these lakes is better understood when their areas are compared with well known lakes of other systems—Lake Superior, 31,820 square miles, Lake Ontario, 7,540 sq. miles and Lake Winnipegosis, 2,086 square miles in area.

Although there is considerable variation in climate within the Mackenzie River basin it has in the main a milder climate than those parts of Ontario, Manitoba and Quebec lying in the same latitude. Midsummer temperatures may rise to 85°F. but the nights are cool and frost may occur at almost any time of the year. In the northern parts of the basin the ground is permanently frozen. The summer season is short, June to September, but varies with the latitude. Precipitation is higher than on the prairies and fairly uniform (15 inches to 20 inches a year) with a snowfall of about 2 feet. Agriculture is possible in the Central Plains area and in parts of the Cordilleran region, mainly in the river valleys. Most of the northern lowland area, however, is not suited to agriculture because of muskeg and permanent frost. It is in the southern portion, in the basins of Athabasca and Peace Rivers, that extensive areas (about 10 million acres) suitable for farming are found; this is prairie and slightly-wooded land and in recent years much of the prairie land has been settled.

Because of lack of transportation, this huge basin has been little explored until recent years when the wide use of aircraft has brought about major changes and drawn to the attention of many Canadians the important resources of the area. Until recently the main activity of the basin was fur-trading and most of the settlements were developed for this purpose. Recent important finds of minerals such as lead, zinc, copper and uranium together with increasing transportation facilities will doubtless open up the basin to further development.

YUKON RIVER DRAINAGE BASIN

The Yukon River basin is about half the size of the Mackenzie River basin, and the river itself drains about 330,000 square miles, 129,000 square miles in Canada, 93 per cent of which is in Yukon Territory, the remainder in British Columbia. This system, the fifth largest in North America, has its headwaters in the Pacific coastal range in northern British Columbia, about 18 miles from tide water, yet the rivers continue about 2,300 miles (714 miles in Canada) before emptying into the Bering Sea. The system has no large lakes in Canada and the main tributary rivers are the Yukon (formerly Lewes) and Teslin Rivers.

The Canadian part of the drainage basin lies entirely within the Cordilleran region, mostly on the high plateau between the Pacific coastal ranges and the Dawson and Selwyn Mountains, which lie parallel and west of the Rocky and Mackenzie Mountains. This plateau area is one of wide valleys and rolling hills separated by deeply cut rivers. The coastal ranges are high and include Mount Logan, one of the highest mountains in North America.

Because of terrain and climate there is little farming in the area, although at one time there was considerable agricultural activity near Whitehorse and Dawson. The area is forested, usually up to 4,000 feet above sea level but growth is slow and what lumbering is done is for local uses.

As in the Mackenzie River basin, climate, distance from populated areas and lack of transportation have slowed development of this basin. One railway runs from Whitehorse 110 miles southwest to Skagway, Alaska. The Alaska Highway connects settled areas of northern British Columbia and Alberta with Whitehorse and another road runs north to Mayo, Dawson and several newer mining communities.

In recent years important finds of base metals and developments of water power have occurred. Fur-trading is also important and some gold mining is still carried on in the older goldfields of the Klondike.

SURVEY PROCEDURE

Survey studies in these and other basins were carried out where possible by the procedures detailed in Water Survey Report No. 1.

During the summer of 1951 when field studies were being made on water quality in the Saskatchewan River drainage basin¹, most of the Upper Mackenzie River basin that was accessible by road was visited, and a number of sampling locations established.

In the rest of the Mackenzie River basin and in the Yukon River basin similar sampling locations were established prior to 1952, by correspondence with municipal officials and with the cooperation of other governmental agencies, in particular the RCMP. The number of stations established in these relatively inaccessible

¹ Industrial Water Resources of Canada (Water Survey Report No. 7): Saskatchewan River Drainage Basin, Mines Branch Report No. 849, Dept. Mines and Technical Surveys, Ottawa, 1956.

areas was necessarily limited because of the high cost and difficulty of collection and shipment of samples, especially during the winter period. At certain locations samples collected during this period were sealed and held until shipment could be made after the spring break-up. Consequently, the quality data available in these basins are limited in comparison with those of previous reports in this series.

Only the southern part of the Mackenzie River basin—that portion accessible by road—was visited with the mobile laboratory when field work was carried out in the summer of 1952. At this time samples of many surface waters, not already being sampled in the monthly survey, were obtained and field-tested. These samples are reported in Tables II, III and IV, with some of the field results reported in brackets. The field tests indicate significant changes, if any, in water quality because of storage prior to complete analysis.

During the 1952 field season most of the incorporated municipalities with organized water systems were visited, and information on the operation of the systems and samples of raw and finished municipal waters were collected. Any information on new systems or changes made since then have been obtained by correspondence with municipal or provincial government officials. However it is probable that additional changes in some of the older systems as well as new installations will have occurred by the time this report is available.

Additional data on surface water quality in these basins and in the drainage basins already reported are continually being obtained. It is planned to make such information available as soon as possible in supplements to this series.

ANALYTICAL PROCEDURE

The methods of analyses and of recording analytical results during studies in these basins were essentially the same as those outlined in Water Survey Report No. 1, although some changes in the number of and method of analyses have since been made and reported in Water Survey Reports up to and including No. 7.

Experience has shown that many field tests with normal field equipment are not accurate enough. To carry out these tests satisfactorily in the field would require the use of elaborate equipment in a larger and specially designed mobile laboratory. It has been found that when certain tests can be carried out within a few days, as is now the policy, there is little significant change in most surface waters. This is also true of many ground waters with the exception of those high in iron or manganese. With the latter, collection of a separate acidified sample permits determination of the iron and manganese in solution at the time of sampling. The amount of field testing has, therefore, been cut to a minimum and now only pH, alkalinity, colour and turbidity are usually determined in the field, although at times such tests as total hardness, dissolved oxygen and iron content are carried out.

As pointed out in previous reports in this series the amount of analytical study on each water is governed to a large extent by the number of samples received, the area covered, and the laboratory personnel available to carry out the analytical work.

Because of the demand for information, each succeeding report attempts to present more information on water quality. This is made possible by the use of more sensitive and rapid analytical methods and techniques. However, the methods used are still those published in editions of "Standard Methods"¹ and A.S.T.M. Manual on Industrial Water².

As in previous reports no attempt has been made to determine weighted averages on surface waters in these basins, because flow records are not available at many sampling locations. At sampling stations where monthly samples were collected, arithmetical means have been reported for many constituents and per cent sodium, sum of constituents and saturation index calculated for these "average" waters. It is pointed out, however, that these "averages" must be used with caution since they have little meaning for waters which show very wide and rapid variations in flow and quality over the year. Inclusion of abnormal spring run-off water in the calculation will often significantly alter the average reported. The reader is referred to Water Survey Report No. 1 for interpretation of per cent sodium, saturation index and other values reported in Tables II, III and IV.

¹ Standard Methods for the Examination of Water, Sewage and Industrial Waters, 9th Edition (1946)—American Public Health Association, 1790 Broadway, New York 17, N.Y.

² Manual on Industrial Waters; 1953—American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pa.

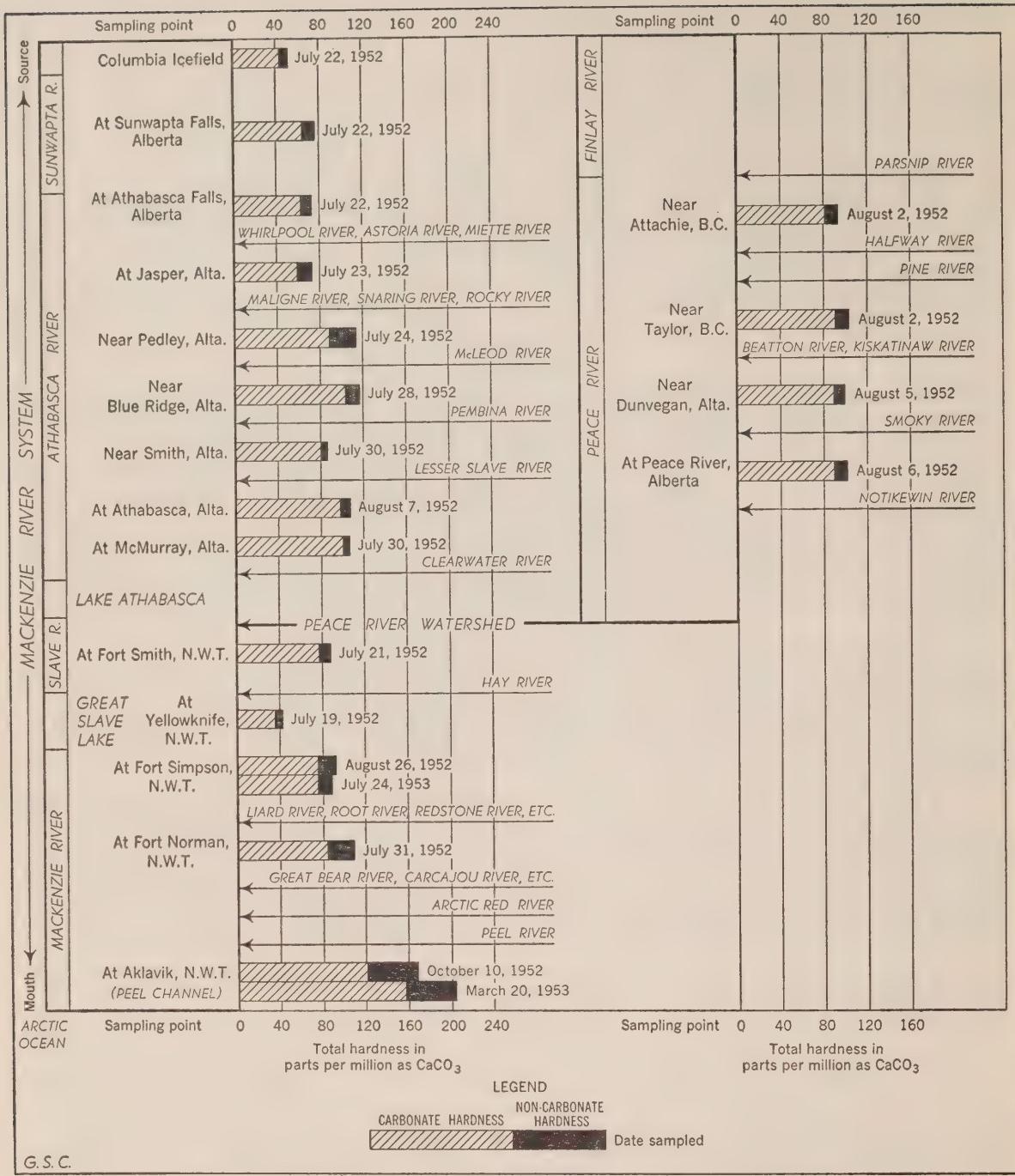
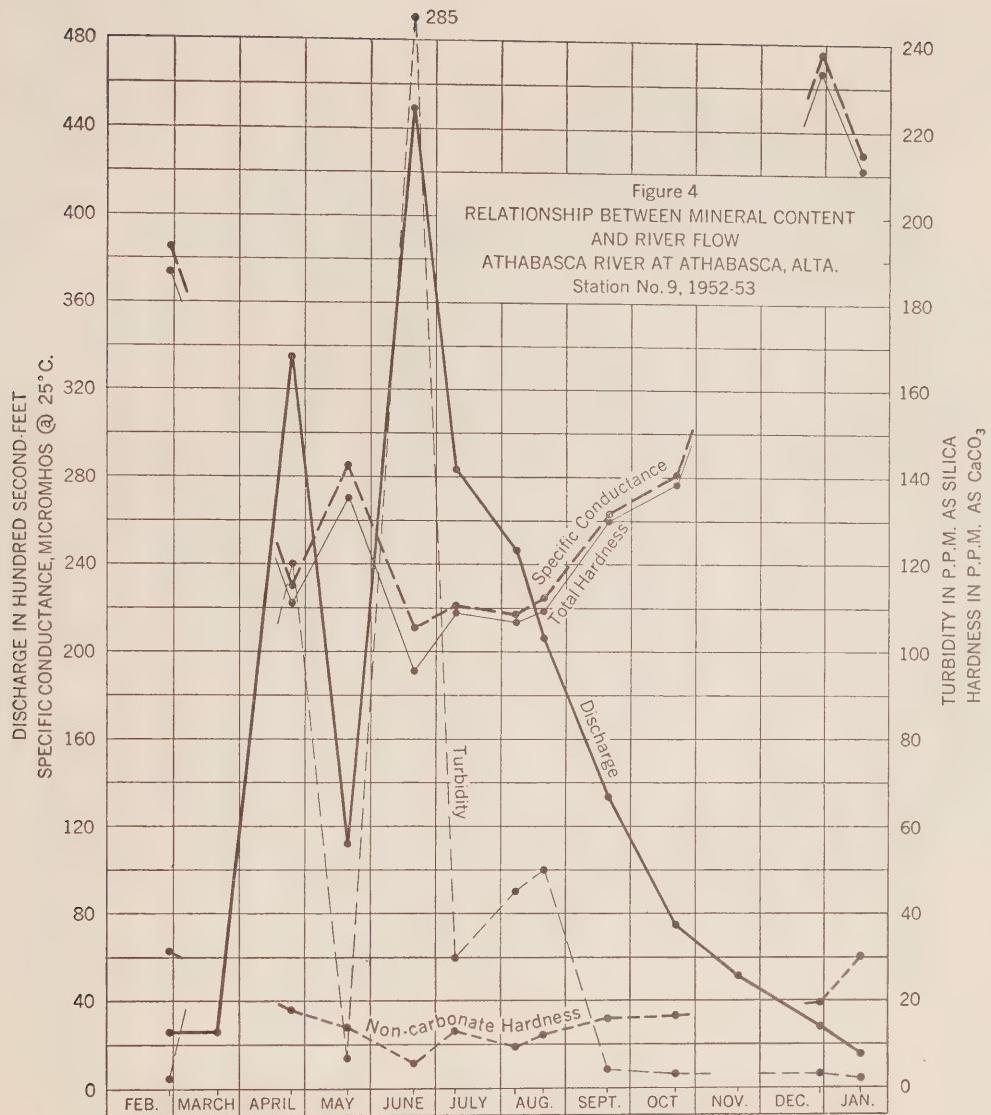
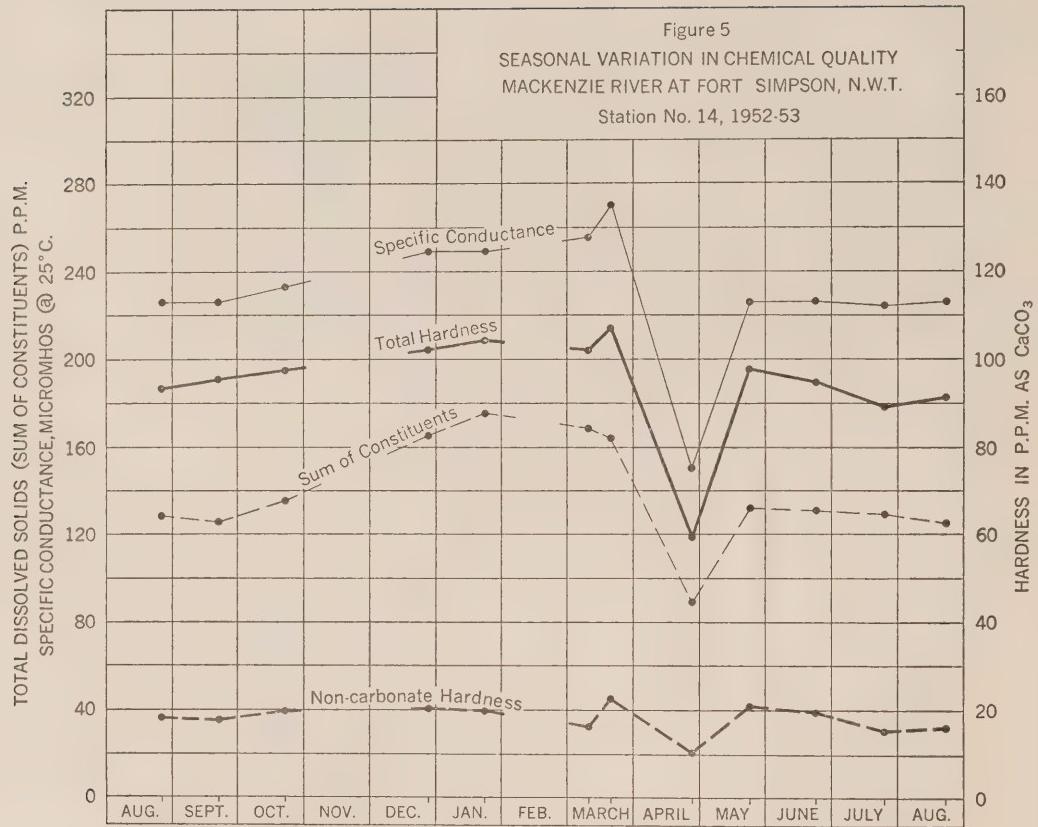


FIGURE 3. GRAPH SHOWING CHANGE IN WATER HARDNESS ALONG MACKENZIE RIVER SYSTEM





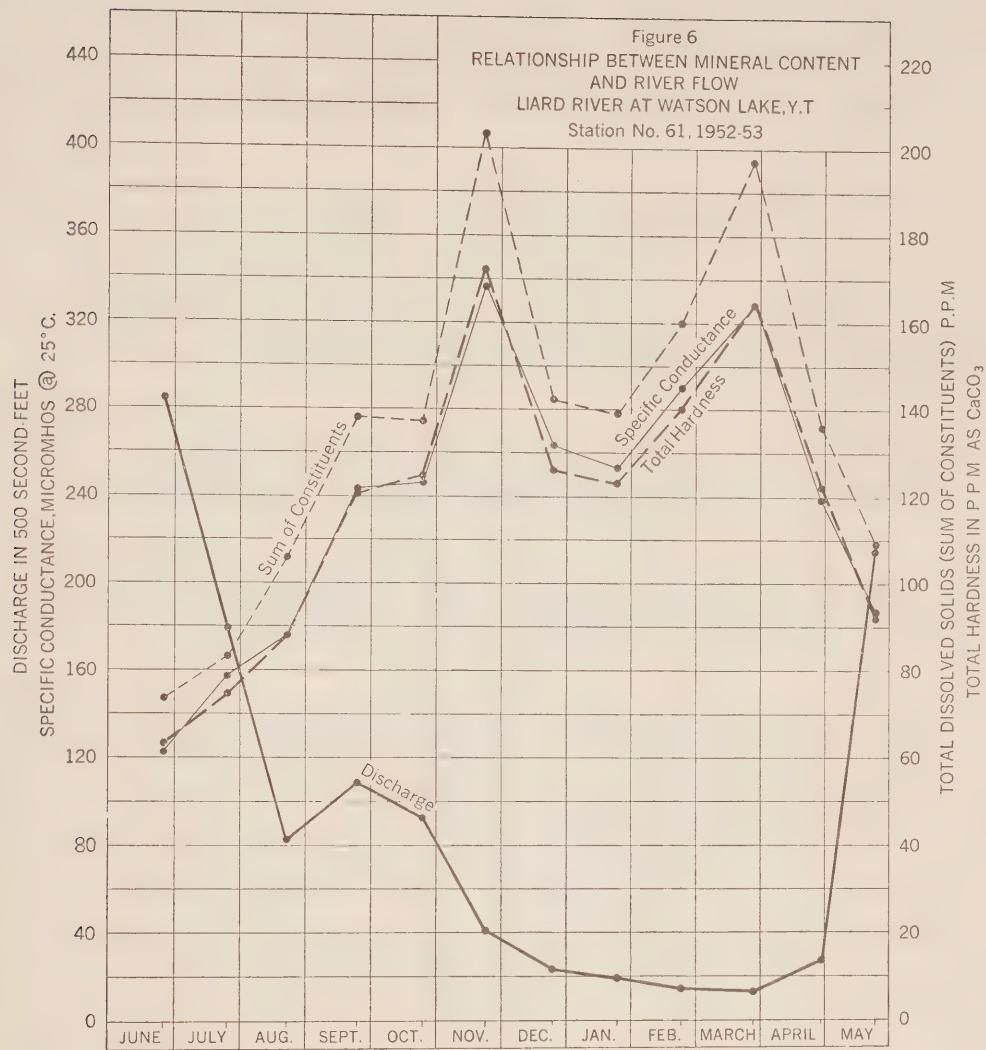


TABLE II
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin
(*In parts per million*)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^4$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)			Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day	

STATION No. 1—ATHABASCA GLACIER†

1	July 21/51.....	.....	174††	201††	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
2	July 22/52.....	8:8*	32.4	58.6	39	8.1 (8.5)	0 (5)	35 (50)	37	35	102	63.2	0.088	5.5	12.4
3	April 6/56.....	-20 0.05	less than	.....	32	8.1	5	0	.....	.....	217	123	0.167	.....	18.0

* Figure preceding colon refers to storage period prior to "immediate" testing, and that following colon to storage period prior to start of final analyses.

† Sampled from pool at base of glacier; this pool is the headwaters of the Sunwapta River.

†† Discharge at Athabasca Glacier.

STATION No. 2—SUNWAPTA RIVER

4	July 22/52.....	8:8	45	7.8 (8.2)	0 (5)	30 (25)	4	40	151	102	0.139	24.0
---	-----------------	-----	-------	-------	----	--------------	----------	------------	---	----	-----	-----	-------	-------	------

STATION No. 3—ATHABASCA RIVER

5	July 22/52.....	8:13	47	7.9 (8.0)	5 (15)	25 (40)	59	57	143	88.2	0.120	35.0
---	-----------------	------	-------	-------	----	--------------	-----------	------------	----	----	-----	------	-------	-------	------

STATION No. 4—ATHABASCA RIVER

6	Feb. 19/52.....	7.7	low‡	.....	32	7.9	2	3	.....	.....	213	133	0.181	.....	12.6
7	Mar. 11.....	8:8	low	.....	33	8.0	5	4	.....	.....	215	.....	.....	.....	.....
8	Mar. 19*.....	7:8	"	.....	34	7.8	5	3	.....	.....	407	.....	.....	.....	.....
9	Apr. 12.....	9:11	"	.....	36	7.6	5	1	.....	.....	202	.....	.....	.....	.....
10	May 12.....	4:10	"	.....	38	8.0	25	15	23	22	157	102	0.139	.....	18.8
11	June 14.....	10:23	high	.....	45	8.2	10	15	.....	.....	136	.....	.....	.....	.....
12	July 9.....	5:6	"	.....	51	8.1	10	60	124	110	131	77.2	0.105	.....	9.6
13	July 23*.....	8:12	"	.....	49	8.0 (8.1)	5 (15)	35 (35)	53	48	141	85.2	0.116	.....	28.6
14	Aug. 12.....	8:28	"	.....	52	8.1	10	250	.....	.....	126	.....	.....	.....	.....
15	Sept. 11.....	6:14	normal	.....	48	7.9	5	4	.....	.....	155	.....	.....	.....	.....
16	Oct. 11.....	5:9	low	.....	43	8.0	5	7	.....	.....	164	.....	.....	.....	.....
17	Nov. 19.....	9:21	low	.....	33	8.1	10	1	.....	.....	344	211	0.257	.....	19.8

* Not included in average.

† Estimate of river level or flow by sample collector.

TABLE II—Continued

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂) Colorimetric	Hardness as CaCO ₃ Non-carbonate	Total	Sum of constituents	Per cent sodium	Saturation index	
		Sodium (Na)	Potassium (K)														No.	+

COLUMBIA ICEFIELD

.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1		
13.8	4.2	0.9	0.2	0.05	8.9	0.1	0.2	trace	.....	47.8	2.9	1.7	7.7	51.7	56.5	3.6	.....	0.5	2
23.7	11.1	0.7	0.5	0.0	25.5	0.3	0.8	0.0	.....	97.6	0	2.6	24.8	105	113	1.4	.....	0.1	3

at SUNWAPTA FALLS, ALTA.

19.7	6.6	1.3	0.2	0.09	13.4	0.2	0.4	0.10	78.1	0	4.0	12.3	76.3	84.5	3.6	0.5	4
------	-----	-----	-----	------	------	-----	-----	------	-------	------	---	-----	------	------	------	-----	-------	-----	---

at ATHABASCA FALLS, ALTA.

20.0	5.4	0.7	0.3	0.07	11.1	1.8	0.2	0.05	76.1	0	3.4	9.9	72.3	80.3	2.1	1.7	5
------	-----	-----	-----	------	------	-----	-----	------	-------	------	---	-----	-----	------	------	-----	-------	-----	---

at JASPER, ALTA.

27.2	9.3	1.0	0.2	0.07	16.2	0.7	0	0.60	.....	109	0	4.2	17.1	106	113	.....	.....	6
25.5	9.5	1.6	0.2	.....	20.6	0.1	0.4	.....	.....	107	0	5.3	14.7	103	116	.....	.....	7
53.6	14.6	8.8	1.2	.....	46.9	1.3	0	.....	.....	196	0	5.1	32.8	194	228	.....	.....	8
27.8	8.9	2.0	0.3	.....	28.8	1.8	0	.....	.....	97.6	0	5.3	26.0	106	123	.....	.....	9
21.7	6.8	1.0	1.3	0.11	12.3	1.0	0.2	0.10	.....	86.6	0	4.6	11.1	82.1	92.9	.....	.....	10
17.0	5.8	1.0	0.3	.....	12.8	1.4	0.3	.....	.....	61.7	2.4	4.8	11.6	66.2	76.6	.....	.....	11
17.5	5.1	0.8	0.3	0.10	12.2	0.1	0.2	trace	.....	64.7	0.6	4.4	10.6	64.6	72.9	.....	.....	12
19.4	5.8	0.9	0.3	0.06	11.9	1.1	0.10	0.0	.....	72.7	0	4.1	12.7	72.3	79.5	.....	.....	13
19.0	4.0	0.4	0.2	.....	7.8	0.4	0.3	.....	.....	66.1	1.2	3.2	7.7	63.9	69.1	.....	.....	14
20.9	6.5	0.9	0.4	.....	19.1	0.8	trace	.....	.....	74.7	0	4.6	17.6	78.8	90.0	.....	.....	15
21.0	6.8	0.6	0.2	.....	17.5	2.4	0.2	.....	.....	76.9	0	6.2	17.3	80.3	92.8	.....	.....	16
45.3	12.6	9.3	1.8	0.23	35.0	1.1	0.3	0.10	.....	162	9.6	4.6	15.8	165	200	.....	.....	17

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(*In parts per million*)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^6$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)		Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day

STATION No. 4—ATHABASCA RIVER

1	Dec. /52—No sample taken.														
2	Jan. /53—No sample taken.														
3	Feb. 4.....	9:36	low	.....	35	8.5	3	1	.....	.....	195	117	0.159	.....	12.6..
4	Mar. 4.....	9:23	"	.....	33	8.2	5	1	.....	.....	207	.....	.....	.....	.....
5	Apr. 4*.....	6:49	"	.....	35	8.2	3	5	.....	.....	210	.....	.....	.....	.....
6	Average.....	7:16	.....	.....	40	8.1	8	30	.....	.....	187	.....	.....	.....	.....

* Not included in average.

STATION No. 5—ATHABASCA RIVER,

7	Sept. 10/50.....	5:129	.....	.....	47	7.8 (8.2)	7 (—)	10 (20)	200	135	160	106	0.144	.....	33.6
8	Sept. 26/51.....	13:33	.....	.....	35	7.7	1	8	8.5	5.4	162	104	0.141	.....	16.2

* At bridge, east of Jasper, Alta.

STATION No. 6—ATHABASCA RIVER

9	July 24/52.....	7:14	53	8.0 (8.2)	5 (15)	25 (25)	222	140	0.190	22.2
---	-----------------	------	-------	-------	----	--------------	-----------	------------	-------	-------	-----	-----	-------	-------	------

STATION NO. 7—ATHABASCA RIVER

10	Sept. 27/51†.....	12:34	Gauge height in feet‡		33	8.1	2	7	8.2	7.2	289	183	0.249	.....	57.0
			No	discharge											
11	Feb. 11/52.....	9:9	12'	.....	33	7.6	5	4	2.0	1.5	440	279	0.379	.....	20.4
12	Mar. 12.....	7:7	11'4"	.....	33	8.0	5	3	.....	.....	434	.....	.....	.....	.....
13	Apr.—No sample taken.														
14	May 7.....	7:8	8'	records	45	7.9	20	1	.....	.....	287	182	0.248	.....	30.6
15	June 12.....	8:25	14'	available.	50	7.8	15	50	.....	.....	210	.....	.....	.....	.....
16	July 11.....	11:18	15'	.....	60	8.0	10	25	.....	.....	208	.....	.....	.....	.....
17	July 28†.....	9:14	.....		65	8.1	30	20	44	41	229	149	0.203	.....	37.8
18	Aug. 18.....	7:18	15'	.....	52	8.0	10	45	.....	54	217	137	0.186	.....	21.8
19	Sept. 12.....	10:17	14'	.....	49	8.1	20	7	.....	.....	263	.....	.....	.....	.....
20	Oct. 13.....	18:43	14'	.....	45	8.1	5	4	8	6	290	173	0.235	.....	14.0
21	Nov. 9.....	16:26	12'	.....	33	8.2	10	3	.....	.....	349	.....	.....	.....	.....

† At ferry, 3 miles north of Blue Ridge; sample not included in average.

†† From highway bridge near Blue Ridge; sample not included in average.

‡ Sample collectors report.

TABLE II—Continued
 Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
 (In parts per million)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂) Colorimetric	Hardness as CaCO ₃ Non-carbonate	Total	Sum of constituents	Per cent sodium	Saturation index	No.
		Sodium (Na)	Potassium (K)															

at JASPER, ALTA.—Concluded

25.4	8.6	1.0	0.4	0.06	21.4	0.0	0.4	0.0	.....	96.1	2.9	4.9	15.3	98.9	112	.....	.....	1
27.3	8.9	1.1	0.4	.....	21.8	0.3	0.6	.....	.....	105	0	4.7	18.9	105	117	.....	.....	2
27.0	9.0	3.5	0.8	.....	21.2	0.6	0.4	.....	0.00	109	0	5.1	14.9	105	121	.....	.....	3
24.6	7.7	1.7	0.5	.....	18.8	0.8	0.2	.....	.....	92.3	1.4	4.7	15.2	93.2	163	3.3	.....	4

near SNARING*, ALTA.

23.0	5.9	0.4	0.4	0.10	22.4	0.0	0.4	0.0	.....	83.0	0	3.3	14.0	82.0 (88.0)	97.3	2.3	.....	0.5
22.7	7.3	1.3	0.2	0.02	17.0	1.8	0.0	0.10	.....	83.0	0	1.8	18.6	86.6	93.2	3.1	.....	0.6

near PEDLEY, ALTA.

30.5	9.0	1.9	0.6	0.08	24.7	0.2	0.2	0.10	108	1.4	3.6	24.0 (24.3)	113 (116)	126	3.5	0.0
------	-----	-----	-----	------	------	-----	-----	------	-------	-----	-----	-----	----------------	--------------	-----	-----	-------	-----

near BLUE RIDGE, ALTA.

42.4	11.3	4.5	0.5	0.04	32.3	1.8	0.2	0.13	.....	152	1.2	7.5	25.5	152	177	6.0	0.3	.....
62.3	17.8	4.5	0.4	0.02	69.4	2.7	0.4	0.20	.....	203	0	5.5	62.2	229	263	.....	.....	10
60.8	17.4	6.3	0.4	.....	62.1	0.6	0.4	.....	.....	205	0	7.0	55.3	223	256	.....	.....	11
40.1	10.4	6.6	1.4	0.08	29.8	3.0	0.0	0.10	.....	149	0	3.6	20.8	143	168	.....	.....	12
29.2	8.2	2.6	0.5	.....	22.0	0.5	0.4	.....	.....	110	0	5.2	16.8	107	123	.....	.....	13
29.2	8.2	2.2	0.4	.....	19.0	0.8	trace	.....	.....	110	0	5.2	16.7	107	119	.....	.....	14
33.0	8.3	3.3	0.5	0.09	16.7	1.0	0.2	0.20	.....	123	2.4	7.7	12.1 (10.8)	117 (117)	133	.....	.....	15
31.0	7.1	1.9	0.5	0.10	20.8	0.2	trace	0.0	.....	111	0	4.7	15.8	107	121	.....	.....	16
37.6	9.6	3.1	0.4	.....	27.8	0.4	trace	.....	.....	128	4.1	5.6	21.6	133	152	.....	.....	17
39.0	11.0	3.6	0.6	0.20	33.4	0.5	0.3	0.0	.....	144	0	4.4	24.5	143	164	.....	.....	18
47.9	13.7	5.0	0.5	.....	45.7	0.3	0.4	.....	.....	163	5.5	8.0	33.2	176	207	.....	.....	19

TABLE II—Continued

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^6$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)		Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre- foot	Tons per day

STATION No. 7—ATHABASCA RIVER

No.	Date	Storage period	Gauge height in feet†		32	8.4	10	2	.....	.....	466	.....	.....	.....
			13'6"‡	.....									
1	Dec. 11/52.....	25:61	13'6"‡	.....	32	8.4	10	2	.....	.....	466	.....	.....	.....
2	Jan. 13/53.....	10:45	12'	.....	33	8.2	10	2	.....	.....	458	283	0.385	26.4
3	Average..... (11 samples)	12:25	.....	.....	42	8.0	11	13	.....	.....	329	.....	.....	.....

† Collectors report.

STATION No. 8—ATHABASCA RIVER

4	July 30/52.....	8:14	67	7.8 (7.9)	55 (100)	15 (25)	45	41	182	120	0.175	38.0
---	-----------------	------	-------	-------	----	--------------	-------------	------------	----	----	-----	-----	-------	-------	------

* Sampled just below junction of Slave River; water may be mostly Slave River water.

STATION No. 9—ATHABASCA RIVER

5	Feb. 29/52.....	13:14	2,540†	2,623†	34	8.0	5	2	.....	.....	335	234	0.318	1,602	26.0
6	Mar.—No sample taken.....			2,561	.....									
7	Apr. 23.....	17:20	33,430	17,800	39	7.5	40	120	.....	.....	230	.....	.....	.....
8	May 19.....	10:18	11,160	15,140	62	8.2	20	7	15	12	285	182	0.248	5,463	30.8
9	June 19.....	11:18	44,870	41,340	60	7.9	60	285	.....	.....	211	.....	.....	.....
10	July 19.....	10:27	28,370	37,400	66	8.0	20	30	.....	.....	221	.....	.....	.....
11	Aug. 7*.....	13:26	24,610	21,280	67	8.1	30	45	64	58	217	144	0.196	9,524	19.4
12	Aug. 19.....	10:17	20,580	21,280	61	8.1	20	50	.....	70	224	139	0.189	7,697	31.8
13	Sept. 19.....	5:14	11,300	13,070	54	8.3	20	4	.....	.....	263	.....	.....	.....
14	Oct. 20.....	14:31	7,460	8,893	42	8.1	5	3	.....	.....	281	.....	.....	.....
15	Nov.—No sample taken.....			5,108											
16	Dec. 19.....	17:41	2,770	2,289	32.5	8.7	15	3	.....	.....	475	.....	.....	.....
17	Jan. 17/53.....	9:46	1,510	2,108	32.5	8.0	15	2	.....	.....	429	287	0.363	1,084	27.4
18	Average..... (10 samples)	12:25	16,398	16,194	48	8.1	22	50	.....	.....	300	.....	.....	.....

† Ice conditions Oct. 22/51 to April 19/52; Nov. 6/52 to April 30/53.

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(*In parts per million*)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂) Colorimetric	Hardness as CaCO ₃	Non-carbonate	Total	Sum of constituents	Saturation index		
		Sodium (Na)	Potassium (K)														+ | -	No.	
66.1	18.1	6.5	0.8	.....	62.3	0.8	0.3	.....	221	8.0	8.7	44.7	240	280	.....	.....	1	
63.5	18.0	6.0	0.7	0.05	64.3	0.6	0.6	0.15	0.00	223	0	6.2	49.9	233	269	.....	.....	2
46.1	12.7	4.4	0.6	.....	41.5	0.9	0.3	.....	161	1.6	5.8	32.3	167	193	5.4	.....	0.4	3

near BLUE RIDGE, ALTA.—*Concluded*

66.1	18.1	6.5	0.8	.....	62.3	0.8	0.3	.....	221	8.0	8.7	44.7	240	280	.....	.....	1	
63.5	18.0	6.0	0.7	0.05	64.3	0.6	0.6	0.15	0.00	223	0	6.2	49.9	233	269	.....	.....	2
46.1	12.7	4.4	0.6	.....	41.5	0.9	0.3	.....	161	1.6	5.8	32.3	167	193	5.4	.....	0.4	3

near SMITH*, ALTA.

24.6	6.3	4.7	1.3	0.16	14.0	1.1	0.2	0.40	97.6 (95.2)	0 (0)	6.9	7.1 (8.9)	87.1 (86.9)	108	10.3	0.3	4
------	-----	-----	-----	------	------	-----	-----	------	-------	----------------	----------	-----	--------------	----------------	-----	------	-------	-----	---

at ATHABASCA, ALTA.

51.1	14.5	8.0	1.2	0.05	46.7	1.2	0.6	0.20	.....	190	0	4.7	31.1	187	222	.....	.....	5
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	6
33.9	6.3	3.0	1.8	.....	26.0	0.9	1.4	.....	.....	112	0	5.8	18.5	111	134	.....	.....	7
38.9	9.2	7.5	1.7	0.04	27.9	1.4	0.1	0.30	0.02	145	1.2	5.8	13.7	135	166	.....	.....	8
29.0	5.6	4.3	1.4	.....	12.6	1.6	0.6	.....	.....	110	0	6.5	5.6	95.6	116	.....	.....	9
31.2	7.6	3.3	0.6	.....	17.1	0.2	0.0	0.20	.....	113	2.4	6.4	12.9	109	125	.....	.....	10
31.2	7.0	4.0	1.1	0.15	17.6	0.4	0.3	0.20	.....	114	2.4	8.0	9.9	107	128	.....	.....	11
31.2	7.6	3.4	0.8	0.08	18.6	0.3	0.2	0.10	0.00	112	3.1	5.9	12.0	109	127	.....	.....	12
37.4	9.0	4.7	0.9	.....	24.3	0.7	0.2	.....	.....	129	5.0	4.8	15.8	130	151	.....	.....	13
38.3	10.3	5.1	1.0	.....	25.1	1.4	0.4	.....	.....	138	4.8	3.4	16.8	138	158	.....	.....	14
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	15
64.6	17.4	10.8	1.8	.....	45.9	1.0	0.7	.....	.....	260	0	6.7	19.9	233	277	.....	.....	16
57.7	16.2	8.8	1.7	0.10	50.5	1.3	0.7	0.15	0.00	220	0	6.0	30.1	211	252	.....	.....	17
41.3	10.4	5.9	1.3	29.5	1.0	0.5	153	1.7	5.6	17.6	146	173	8.0	0.4	18

* Not included in average.

TABLE II—Continued

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^6$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)		Loss on ignition at 550°C.	
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day	

STATION No. 10—ATHABASCA RIVER†

			Water elevations in feet		63	8.1	10	40	61	56	245	152	0.207	29.2
			790.13	.....									
1	May 31/52.....	2:425	790.13	.....	63	8.1	10	40	61	56	245	152	0.207	29.2
2	June—No sample taken.....													
3	July 30.....	8:16	791.12	.....	71	8.1	50	40	.....	219	.....	.....	.....	.....
4	Aug. }													
5	Sept. }	No samples taken.												
6	Oct. }													
7	Nov. 13/52.....	11:15	no record		43	8.2	25	4	5.4	4.0	352	216	0.294	29.0
8	Dec. 13.....	10:35	"		33	8.5	20	2	.....	452	.....	.....	.....	.....
9	Jan. 27/53.....	10:59	"		32	8.1	10	2	.....	456	.....	.....	.....	.....

Maximum water elevation, June 26/53.

Minimum water elevation, Oct. 31/53.

† Sometimes called Snye River at this location.

STATION No. 11—SLAVE RIVER

			Water elevations in feet		32.5	7.8	.....	0	.....	523	.....	.....	.....	.....
			no record, ice											
10	Mar. 31/52.....	259.294	no record, ice		32.5	7.8	.....	0	.....	523	.....	.....	.....	.....
11	Apr. 30.....	229.264	587.12†	.....	33	7.7	.....	heavy	.....	302	.....	.....	.....	.....
12	June 1.....	198.233	.....		52	7.8	0	"	.....	213	.....	.....	.....	.....
13	June 23.....	10:14	592.70†	.....	56	7.7	.....	500	.....	205	138	0.188	.....	59.4
14	July 21.....	8:25	591.92†	.....	65	7.8	30	60	.....	191	.....	.....	.....	.....
15	Aug. 18.....	11:22	589.72†	.....	61	7.7	20	35	.....	182	.....	.....	.....	.....
16	Sept. 19.....	5:19	587.96†	.....	52	7.9	15	25	60	55	193	118	0.160	15.6
17	Oct. 20.....	11:25	no record, ice		34	7.9	20	40	.....	208	.....	.....	.....	.....
18	Nov. 19.....	8:16	"		33	7.7	10	10	.....	235	.....	.....	.....	.....
19	Dec. 19.....	17:57	"		32	7.8	15	15	19	17	216	120	0.175	19.2
20	Jan. 20/53.....	8:28	658.50†	.....	35	8.3	15	15	.....	329	.....	.....	.....	.....
21	Feb. 18.....	9:37	656.56†	.....	33	7.8	15	8	.....	353	.....	.....	.....	.....
22	Mar. 18*.....	14:66	655.93†	.....	34	8.1	15	10	14	11	378	226	0.307	25.6

† Records above Mountain Rapids.

†† Records at Fitzgerald: at Fitzgerald { Maximum water elevation, June 15/53—665.06 feet.

* Not included in average. { Minimum water elevation, March 30/53—655.76 feet.

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Alkalies		Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂) Colorimetric	Hardness as CaCO ₃ Non-carbonate	Total	Sum of constituents	Per cent sodium	Saturation index		No.
				Sodium	Potassium														+/-	-	

at FORT MACMURRAY, ALTA.

31.6	9.1	6.4	1.2	0.07	21.7	1.6	0.4	0.20	0.03	124	1.2	4.1	12.2	116	138	10.6	0.2	.....	1
32.9	7.0	5.1	1.0	.....	12.6	0.9	0.2	0.40	.....	117	2.4	6.6	6.0	106	127	9.4	0.2	.....	2
44.5	12.4	11.0	1.7	0.03	32.9	3.5	0.2	0.15	.....	178	3.1	5.4	11.0	162	203	12.7	0.5	.....	3
59.0	16.4	16.4	2.0	.....	46.3	2.8	0.6	.....	.....	224	11.3	5.1	12.3	215	270	14.1	1.1	.....	4
59.3	17.2	14.8	2.1	.....	50.2	1.4	1.1	.....	.....	241	0	6.7	21.2	219	271	12.7	0.7	.....	5
																				6
																				7
																				8
																				9

at FORT SMITH, N.W.T.

52.0	11.0	35.4	1.0	.....	60.0	42.2	1.8	.....	.....	169	0	.....	40.5	179	287	.....	.....	.....	10
37.4	8.2	10.0	2.4	.....	37.0	6.8	3.2	.....	.....	124	0	.....	25.2	127	166	.....	.....	.....	11
29.2	5.2	9.0	0.8	.....	18.7	7.6	0.8	.....	.....	103	0	.....	9.5	94.1	122	.....	.....	.....	12
31.5	5.4	3.4	1.7	0.20	13.8	3.3	0.4	.....	.....	111	0	3.1	9.8	101	118	.....	.....	.....	13
25.7	5.7	4.8	1.1	.....	15.0	4.2	0.3	0.20	.....	93.2	0	5.0	11.1	87.5	108	.....	.....	.....	14
29.4	5.1	5.4	0.9	.....	13.2	5.0	0.6	.....	0.00	87.8	0	5.8	10.0	82.0	104	.....	.....	.....	15
23.8	5.3	6.7	1.4	0.04	16.7	8.9	0.3	0.05	.....	85.4	0	4.8	11.2	81.2	110	.....	.....	.....	16
25.9	6.1	6.4	1.2	.....	16.9	7.0	0.4	.....	.....	95.6	0	4.3	11.4	89.8	115	.....	.....	.....	17
26.3	6.4	10.1	1.7	.....	18.3	11.7	0.3	.....	.....	98.6	0	3.7	11.2	92.0	127	.....	.....	.....	18
24.7	5.9	9.9	1.0	0.04	18.6	10.8	3.0	0.20	.....	92.7	0	5.1	9.8	85.8	125	.....	.....	.....	19
36.3	9.0	17.5	1.1	.....	26.0	15.8	0.6	.....	.....	138	0	6.7	14.6	128	181	.....	.....	.....	20
38.9	9.7	18.2	1.2	.....	28.0	22.1	0.6	.....	.....	142	0	6.3	21.2	137	195	.....	.....	.....	21
43.6	9.1	25.7	1.9	0.04	30.9	26.8	.....	0.05	.....	159	0	6.4	15.7	146	223	.....	.....	.....	22

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(*In parts per million*)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^4$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)		Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day

STATION No. 11—SLAVE RIVER

			Water elevation in feet												
1	Apr. 22*	10:45	656.05††		32.5	8.0	10	8			707				
2	May 15*	12:28	{ 591.35† 663.56††	}	44	7.6	.....	1,400	.....		546				
3	Average..... (12 samples)	64:86	.....	.....	43	7.8	16	.....	.....		263	.....	.....	.....

† Records above Mountain Rapids.

†† Records at Fitzgerald; at Fitzgerald Maximum water elevation, June 15/53—665.06 feet.

* Not included in average. (Minimum water elevation, March 30/53—655.76 feet.)

STATION No. 12—GREAT SLAVE LAKE

4	June 15/56†.....	18:53	.....	.....	68	7.8	120	0.3	.....	264	201	0.273	.....	48.0
5	Oct. 23/56†.....	10:19	.....	.....	32	7.8	160	18	.....	391	.....	.....	.....	.....
6	Sept. 19/51*.....	35:42	520‡	48	7.6	3	20	20	19	234	146	0.199	36.8

† Sampled from reservoir at Army installation.

‡ Four miles out in lake.

‡ Elevation at Resolution, N.W.T.—{ Maximum water elevation Aug. 22/51—570 feet.
Minimum water elevation, May 12/51—370 feet.

STATION NO. 12A—GREAT

7	June 14/56.....	18:56	low	47	7.9	10	0.9	.....	174	103	0.140	.....	69.9
8	Nov 22/56.....	7:47	.....	34	8.1	40	.....	.....	272	.....	.....	.....	.....

STATION NO. 12B—GREAT

9	Aug. 23/56.....	47:90	Very low	54	6.9	20	0.8	26.48	24.4	0.033	9.2
---	-----------------	-------	----------	----	-----	----	-----	-------	-------	------	-------	-------	-----

STATION No. 13—GREAT SLAVE

			Gauge height in feet†												
10	July 10/52.....	31:32	493.60	493.57	58	7.4	5	0.6	.....	107	71.6	0.097	.....	25.8
11	Aug.—No sample taken.	.....	493.76	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12	Sept. 11.....	11:18	493.57	493.54	52	7.6	15	0.7	.....	207	.....	.....	.....	.....

† Maximum gauge height, Aug. 28-29/53—493.46.

Minimum gauge height, May 9/53—491.76.

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(*In parts per million*)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂)	Hardness as CaCO ₃	Sum of constituents	Per cent sodium	Saturation index	No.
		Sodium (Na)	Potassium (K)									Colori- metric					

at FORT SMITH, N.W.T.—*Concluded*

61.9	13.3	68.4	1.6	.....	61.5	114	1.0	.....		148	0	6.8	87.5	209	402	.....	.....	1
56.8	7.7	52.7	2.3	.....	59.1	88.1	0.8	.....		120	0	5.0	74.8	174	332	.....	.....	2
31.8	7.0	11.4	1.3	.....	23.5	12.1	1.1	.....		112	0	5.0	16.5	108	147	18.4	.....	0.2

near HAY RIVER SETTLEMENT, N.W.T.

33.3	7.5	7.9	2.6	0.43	59.8	4.1	4.8	0.00	.....	79.2	0	3.5	48.9	114	158	12.6	.....	0.3	4
51.1	12.0	14.4	1.5	.....	94.4	4.7	0.8	.....		124	0	6.1	75.2	176	246	14.7	0	.....	5
30.0	6.4	8.5	1.3	0.05	26.0	10.5	0.4	0.15	.....	95.2	0	3.4	23.2	101	134	15.2	.....	0.5	6

SLAVE LAKE at FORT RESOLUTION, N.W.T.

21.6	3.9	6.3	0.8	trace	17.4	7.7	2.0	0.00	.....	65.9	0	2.7	15.8	69.9	95.3	15.8	0.4	.....	7
35.1	6.7	11.7	1.2	.....	28.7	11.7	0.8	.....		116	0	5.2	23.6	115	156	17.0	0.2	.....	8

SLAVE LAKE (MCLEOD BAY) at FORT RELIANCE, N.W.T.

2.2	0.9	0.5	0.4	0.00	0.8	0.6	0.8	0.00	11.0	0	0.5	0.2	9.2	12.2	9.6	3.1	9
-----	-----	-----	-----	------	-----	-----	-----	------	-------	------	---	-----	-----	-----	------	-----	-------	-----	---

LAKE at YELLOWKNIFE, N.W.T.

12.3	2.9	3.8	0.8	0.09	11.1	5.0	0.3	0.10	.....	42.2	0	3.6	7.9	42.5	60.8	.....	.....	10
																		11
25.4	4.8	7.1	1.0	.....	20.8	8.7	0.4	.....		83.7	0	4.1	14.7	83.3	114	.....	.....	12

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^6$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)			Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day	

STATION NO. 13—GREAT SLAVE

			Gauge height in feet†		37	7.8	5	2	.....	.....	167	103	0.140	.....	36.4
			493.11	493.03											
1	Oct. 20.....	14:39	493.11	493.03	37	7.8	5	2	.....	.....	167	103	0.140	.....	36.4
2	Nov. 19.....	8:21	492.61	492.54	33	7.3	10	0.6	.....	.....	46.7	32.8	0.045	.....	12.2
3	Dec. 26.....	11:40	492.25	492.37	33	7.6	10	2	.....	.....	45.4	32.8	0.045	.....	13.6
4	Jan. 20/53.....	8:28	492.18	492.22	32	7.3	10	1	.....	.....	45.5	.....	.....	.....	.....
5	Feb. 19.....	8:36	492.18	492.18	32	7.1	10	1	.....	.....	55.6	37.2	0.051	.....	14.2
6	Mar. 18.....	9:58	492.03	492.05	32	7.0	15	1	.....	.....	60.1	.....	.....	.....	.....
7	Apr. 20.....	12:47	491.93	491.95	34	7.4	5	0	.....	.....	48.2	.....	.....	.....	.....
8	May 23.....	5:14	492.03	491.97	40	7.0	10	0	.....	.....	48.1	31.6	0.043	.....	13.8
9	June 17.....	9:28	.....	492.41	55	7.5	10	4	.....	.....	91.8	.....	.....	.....	.....
10	Average..... (11 samples)	12:33	492.55	492.63	40	7.4	10	1	.....	.....	83.9	.....	.....	.....	.....

† Maximum gauge height, Aug. 28-29/53—493.46

Minimum gauge height, May 9/53—491.76.

STATION NO. 13A—

11	Aug. 21/56.....	66:92	low	46	8.1	10	6	10.2	5.8	230	151	0.205	23.2
----	-----------------	-------	-----	----	-----	----	---	------	-----	-----	-----	-------	-------	------

STATION No. 14—MACKENZIE RIVER

			Water elevations in feet		58	8.0	5	9	14	12	226	137	0.186	.....	18.8
			10.03	.....										
12	Aug. 26/52.....	64:67	9.00	.....	50	8.0	10	20	.....	.....	227	.....	.....	.....	.....
13	Sept. 22.....	37:53	ice, no record	.....	38	8.0	0	slight	.....	.....	233	.....	.....	.....	.....
14	Oct. 22.....	127:176	"	.....	32	7.7	0	considerable	.....	.....	240	.....	.....	.....	.....
15	Nov.—No sample taken.				32	7.9	.....	.....	.....	.....	249	186	0.253	.....	52.8
16	Dec. 27.....	41:90	"	.....	32	7.9	10	2	.....	.....	256	.....	.....	.....	.....
17	Jan. 23/53.....	14:36	"	.....	32	7.6	10	7	.....	.....	270	.....	.....	.....	.....
18	Feb.—No sample taken.				32	7.0	10	6	.....	.....	151	.....	.....	.....	.....
19	Mar. 10.....	167:220	"	.....	32	7.9	10	2	.....	.....	.....	.....	.....	.....	.....
20	Mar. 20.....	167:233	"	.....	32	7.6	10	7	.....	.....	.....	.....	.....	.....	.....
21	Apr. 27.....	160:172	"	.....	32	7.0	10	6	.....	.....	.....	.....	.....	.....	.....

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂) Colorimetric	Hardness as CaCO ₃	Sum of constituents	Per cent sodium			No.
		Sodium (Na)	Potassium (K)												+ | -	- | +		

LAKE at YELLOWKNIFE, N.W.T.—Concluded

20.8	4.3	5.7	0.8	0.03	16.6	7.0	0.7	0.15	0.00	68.6	0	3.0	13.6	69.8	92.9	.....	1
4.9	1.7	1.8	0.9	0.07	5.0	1.9	0.3	0.05	.....	19.5	0	0.8	3.2	19.2	27.1	.....	2
4.5	1.6	1.8	0.8	0.04	4.7	2.0	2.0	0.15	0.02	18.8	0	1.2	2.4	17.8	28.1	.....	3
4.9	1.4	3.4	0.9	.....	3.1	5.8	0.4	.....	.....	18.1	0	0.7	3.0	17.8	29.5	.....	4
4.6	1.6	2.4	1.2	0.06	5.1	1.8	0.9	0.10	.....	19.8	0	1.3	2.0	18.2	28.7	.....	5
5.0	1.8	2.3	1.6	.....	4.9	1.4	1.2	.....	.....	22.9	0	0.8	1.0	19.8	30.3	.....	6
4.9	2.1	2.1	1.1	.....	5.3	1.6	0.8	.....	0.00	22.0	0	1.3	2.8	20.8	30.0	.....	7
5.8	0.9	2.0	1.3	0.04	4.4	0.8	0.3	0.03	0.00	21.9	0	0.3	0	18.0	26.7	.....	8
9.2	2.7	5.0	1.2	.....	9.3	3.3	0.4	.....	.....	36.8	0	1.5	3.8	34.0	50.7	.....	9
7.7	2.3	3.4	1.1	.....	8.2	3.6	0.7	.....	.....	34.0	0	1.7	0.8	28.7	45.5	19.7	1.6 10

MACKENZIE RIVER at FORT PROVIDENCE, N.W.T.

28.8	5.7	8.5	1.1	0.00	20.8	9.3	1.2	0.00	100	0	4.5	13.3	95.3	129	16.0	0 11
------	-----	-----	-----	------	------	-----	-----	------	-------	-----	---	-----	------	------	-----	------	-------	------

at FORT SIMPSON, N.W.T.

27.4	6.1	7.9	1.1	0.02	23.9	10.1	0.3	0.20	0.03	86.6	2.4	5.3	18.6	93.6	128	.....	12
27.8	6.3	7.6	1.1	.....	23.0	9.5	0.4	.....	.....	94.7	0	3.3	17.7	95.3	128	.....	13
27.6	7.0	8.5	1.2	.....	23.9	10.0	0.9	.....	.....	95.2	0	10	19.7	97.7	136	.....	14
29.1	7.2	11.4	1.2	.....	24.3	11.6	1.0	.....	.....	100	0	30	20.1	102	165	.....	15
29.7	7.2	13.3	1.4	0.18 (total)	28.3	11.8	0.6	.....	.....	102	0	33	19.0	104	176	.....	16
34.9	3.6	11.0	1.7	.....	26.1	10.5	2.4	.....	.....	105	0	26	16.1	102	168	.....	17
31.6	6.8	12.0	2.1	.....	24.3	17.1	1.8	.....	.....	103	0	17	22.1	107	164	.....	18
17.8	3.7	6.5	1.8	.....	15.8	6.7	0.8	.....	.....	60.3	0	7.2	10.4	59.8	89.8	.....	19
																	20 21

TABLE II—Continued

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^4$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)		Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day

STATION No. 14—MACKENZIE RIVER

			Water elevations in feet		51	7.9	10	6	.....	.....	226	.....	.....	.....
			no record	.....										
1	May 23.....	104:159	.....	.....	55	8.1	10	8	13	11	223	152	0.207	.....	34.6
2	June 23.....	73:115	>10.18	.....	63	8.2	10	5	.....	.....	224	.....	.....	.....	.....
3	July 24/53.....	109:166	14.00	.....	66	8.2	10	8	12	9.1	226	142	0.193	.....	23.8
4	Aug. 22*.....	80:152	8.90	.....	59	7.6	60	75	74	46	179	145	.....	.....	33.2
5	May 28/56*.....	30:72	very low	.....	43	7.8	8	.....	.....	.....	230	.....	.....	.....	.....
6	Average..... (11 samples)	97:135	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....

* Not included in average.

Water elevations
 Maximum—July 3/52—16.58; July 28/53—15.65.
 Minimum—Oct. 15/52—8.43; June 9/53—6.43.

STATION No. 15—MACKENZIE RIVER near

			Water elevations in feet†		58	7.9	30	65	143	134	239	153	0.208	.....	52.0
			267.22	.....										
7	July 31/52.....	7:13	.....	.....	46	8.0	30	20	.....	.....	251	.....	.....	.....	.....
8	Aug. 30.....	23:30	.....	.....	47	7.9	20	10	.....	.....	256	.....	.....	.....	.....
9	Sept. 27.....	13:23	264.40	.....	35	8.2	20	slight	.....	.....	309	.....	.....	.....	.....
10	Oct.—Lost in transit.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
11	Nov.—No sample taken.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
12	Dec. 26.....	28:53	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
13	Jan./53	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
14	Feb.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
15	Mar.	No samples taken.	ice, no records	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
16	Apr.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
17	May	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
18	June 7.....	11:25	265.30	.....	55	8.2	10	6	7.9	6.2	158	99.6	0.135	.....	26.6
19	June 29.....	14:43	266.00	.....	57	8.1	.....	285	.....	.....	228	.....	.....	.....	.....
20	June 11/56.....	22:57	.....	.....	60	8.0	30	18	9.1	2.3	233	180	0.245	.....	43.2

† Records at Norman Wells
 Maximum water elevations—July 5/52—271.58; July 21 to 22/53—288.41.
 Minimum water elevations—Aug. 12/52—264.35; Oct. 5/53—262.84.

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(*In parts per million*)

Calcium (Ca)	Magnesium (Mg)	Alkalalis		Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂) Colorimetric	Hardness as CaCO ₃ Non-carbonate	Total	Sum of constituents	Saturation index			No.
		Sodium (Na)	Potassium (K)													+ | -			
29.7	5.6	8.5	1.5	.....	25.2	8.9	0.4	.....	.....	93.2	0	6.4	20.9	97.3	132	.....	.....	.....	1
33.0	3.0	8.8	1.5	0.03	24.1	9.2	0.6	0.15	.....	91.5	0	5.3	19.8	94.8	131	.....	.....	.....	2
26.3	5.8	9.0	1.5	.....	22.6	9.9	0.4	.....	0.07	90.8	0	9.2	15.2	89.6	129	.....	.....	.....	3
26.7	6.0	9.0	1.5	0.02	24.9	5.1	0.4	0.10	.....	91.7	0	6.2	16.0	91.2	125	.....	.....	.....	4
28.0	5.6	1.8	1.1	0.06	16.2	1.8	4.0	0.00	.....	92.0	0	4.6	17.4	92.9	109	4.0	.....	0.5	5
28.6	5.7	9.5	1.5	.....	23.8	10.5	0.9	.....	.....	92.9	0.2	14	18.4	94.9	141	17.6	.....	0.3	6

at FORT SIMPSON, N.W.T.—*Concluded*

29.7	5.6	8.5	1.5	.....	25.2	8.9	0.4	.....	.....	93.2	0	6.4	20.9	97.3	132	.....	.....	.....	1
33.0	3.0	8.8	1.5	0.03	24.1	9.2	0.6	0.15	.....	91.5	0	5.3	19.8	94.8	131	.....	.....	.....	2
26.3	5.8	9.0	1.5	.....	22.6	9.9	0.4	.....	0.07	90.8	0	9.2	15.2	89.6	129	.....	.....	.....	3
26.7	6.0	9.0	1.5	0.02	24.9	5.1	0.4	0.10	.....	91.7	0	6.2	16.0	91.2	125	.....	.....	.....	4
28.0	5.6	1.8	1.1	0.06	16.2	1.8	4.0	0.00	.....	92.0	0	4.6	17.4	92.9	109	4.0	.....	0.5	5
28.6	5.7	9.5	1.5	.....	23.8	10.5	0.9	.....	.....	92.9	0.2	14	18.4	94.9	141	17.6	.....	0.3	6

FORT NORMAN, N.W.T.

31.5	7.3	5.7	0.8	0.12	27.9	6.6	0.0	0.20	.....	103	0	3.0	24.5	109	134	10.2	.....	0.1	7
33.4	7.5	6.4	0.7	.....	29.4	7.6	trace	.....	.....	108	0	4.6	25.7	114	143	10.8	.....	0.1	8
33.3	7.5	8.1	0.8	.....	30.7	9.4	0.3	.....	.....	108	0	4.6	25.2	114	148	13.3	.....	0.1	9
37.9	8.9	13.0	1.3	.....	36.6	12.3	1.2	.....	.....	134	0	6.3	21.4	131	184	17.7	0.4	.....	12
																			13	
																			14	
																			15	
																			16	
																			17	
17.2	5.6	6.3	1.2	0.03	15.5	6.2	0.8	0.00	.....	69.3	0	2.0	9.2	66.0	88.9	16.9	.....	0.2	18
28.5	6.8	15.8	1.2	.....	27.8	6.2	0.1	.....	0.00	124	0	4.0	0.0	99.0	151	25.4	0.1	.....	19
29.2	7.6	6.6	1.1	0.11	23.3	8.4	4.0	0.00	.....	97.3	0	3.7	24.3	104	132	11.8	0.1	.....	20

TABLE II—Continued

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^6$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)		Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day
1	June 13/56.....	26:57	high	.....	7·8	40	11	8·8	3·9	219	134	0·182	.....	39·2
2	Nov. 9/56.....	20:49	low	34	8·2	20	.....	.....	290	.....	.....	.....	.....	.....

STATION No. 15A—MACKENZIE

1	June 13/56.....	26:57	high	.....	7·8	40	11	8·8	3·9	219	134	0·182	.....	39·2
2	Nov. 9/56.....	20:49	low	34	8·2	20	.....	.....	290	.....	.....	.....	.....	.....

STATION No. 16—MACKENZIE RIVER

3	Dec. 4/49.....	-30	.....	32	7·5	12	1	.....	.....	388	244	0·332	.....	38·2
4	Oct. 20/52.....	318:361	low†	.....	32	8·0	10	15	.....	342	.....	.....	.....	.....
5	Nov. 20.....	287:343	“	.....	32	7·8	10	7	.....	399	.....	.....	.....	.....
6	Dec. 20.....	258:300	“	.....	32	8·3	5	2	.....	401	258	0·351	.....	39·4
7	Jan. 20/53.....	225:282	“	.....	32	7·6	10	2	.....	460	.....	.....	.....	.....
8	Feb. 20.....	196:251	normal	.....	32	7·6	5	3	.....	424	.....	.....	.....	.....
9	Mar. 20/53.....	166:210	normal†	32	7·9	5	3	2·9	0·7	403	253	0·344	43·4

† Collector's estimate of river flow or level.

STATION NO. 16A

10	Sept/56†.....	.....	.....	50	8·3	10	50	.....	.....	267	.....	.....	.....	.....
11	Sept./56††.....	.....	.....	50	8·3	10	40	.....	.....	268	.....	.....	.....	.....

† Sampled at half depth at shore line.

†† Sampled at centre of channels at half depth, opposite wharf.

STATION No. 17—WHIRLPOOL RIVER at highway

12	July 22/52.....	8:13	47	7·9 (8·1)	0 (10)	10 (15)	28	27	123	80·0	0·109	30·6
----	-----------------	------	-------	----	--------------	-----------	------------	----	----	-----	------	-------	-------	------

STATION No. 18—ASTORIA RIVER at highway

13	July 22/52.....	8:13	47	7·5 (7·8)	5 (15)	7 (10)	12·5	12·4	90·3	64·2	0·087	18·2
----	-----------------	------	-------	----	--------------	-----------	-----------	------	------	------	------	-------	-------	------

STATION No. 19—MIETTE RIVER at

14	July 22/52.....	8:13	49	7·6 (7·7)	5 (15)	7 (5)	16	15	123	80·2	0·109	45·0
----	-----------------	------	-------	----	--------------	-----------	----------	----	----	-----	------	-------	-------	------

Carbon dioxide (field test)—0·5 p.p.m.

TABLE II—Continued

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂)	Hardness as CaCO ₃	Sum of constituents	Per cent sodium	Saturation index		No.
		Sodium (Na)	Potassium (K)									Colori- metric				+	-	
27.6	6.8	6.1	1.0	0.09	21.9	7.5	4.0	0.00	.....	91.8	0	4.0	21.5	96.8	125	11.7	0.3	..... 1
30.7	12.6	8.8	1.3	.....	31.7	10.2	0.8	.....	.....	126	0	5.3	24.5	128	163	12.9	0.2	..... 2

RIVER at FORT GOOD HOPE, N.W.T.

27.6	6.8	6.1	1.0	0.09	21.9	7.5	4.0	0.00	.....	91.8	0	4.0	21.5	96.8	125	11.7	0.3	..... 1
30.7	12.6	8.8	1.3	.....	31.7	10.2	0.8	.....	.....	126	0	5.3	24.5	128	163	12.9	0.2	..... 2

(PEEL CHANNEL) at AKLAVIK, N.W.T.

56.9	17.0	6.8	0.7	0.03	59.9	3.6	0.4	0.20	.....	168	0	.....	74.6	212	234	6.5	.....	0.1 3
48.9	11.3	7.2	1.8	.....	61.9	2.1	0.8	.....	.....	147	0	11	48.1	169	218	8.3	0.4	..... 4
54.0	15.1	8.0	1.8	.....	62.8	3.8	1.2	.....	.....	176	0	12	52.9	197	246	8.0	0.3	..... 5
55.2	15.7	6.1	1.2	0.02	60.3	4.2	2.0	0.05	.....	182	0	8.0	53.5	203	242	6.1	0.8	..... 6
57.4	17.4	8.1	2.4	.....	61.3	5.7	80.0	.....	.....	124	0	8.6	113	215	302	7.5	0	..... 7
57.4	18.0	6.0	1.3	.....	56.4	4.4	2.4	.....	.....	198	0	8.9	54.8	217	251	5.6	0.2	..... 8
55.0	16.1	6.1	1.2	0.02	53.3	4.9	1.6	0.05	.....	193	0	7.2	45.5	204	241	6.1	0.5	..... 9

MACKENZIE RIVER at NEW AKLAVIK, N.W.T.

33.5	7.8	7.7	0.9	0.02	30.7	9.5	0.0	0.00	.....	111	0	3.6	24.8	116	148	12.6	0.4	..... 10
33.6	8.0	8.1	1.0	0.04	29.7	9.6	0.0	0.00	.....	114	0	3.0	23.5	117	149	12.9	0.4	..... 11

bridge near ATHABASCA FALLS, ALTA.

17.1	4.6	1.3	0.2	0.05	9.2	0.9	0.1	0.00	66.6	0	5.1	7.0	61.6	71.4	4.4	0.5 12
------	-----	-----	-----	------	-----	-----	-----	------	-------	------	---	-----	-----	------	------	-----	-------	--------

bridge south of JASPER, ALTA.

9.2	4.5	1.1	0.2	0.07	14.6	1.0	0.0	0.00	34.2	0	4.1	13.5	41.5	516	5.4	1.4 13
-----	-----	-----	-----	------	------	-----	-----	------	-------	------	---	-----	------	------	-----	-----	-------	--------

bridge near JASPER, ALTA.

12.6	6.5	1.1	0.2	0.06	22.3	0.6	0.1	0.10	45.6	0	4.1	20.9	58.3	70.2	3.9	1.1 14
------	-----	-----	-----	------	------	-----	-----	------	-------	------	---	-----	------	------	------	-----	-------	--------

TABLE II—Continued

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

No.	Date of collection	Storage Period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance K x 10 ⁴ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)		Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day

STATION No. 20—MALIGNE RIVER at

1	July 23/52.....	8:12	45	7.6 (7.8)	5 (10)	0.6	198	121	0.165	45.4
---	-----------------	------	-------	-------	----	--------------	-----------	-----	-------	-------	-----	-----	-------	-------	------

Carbon dioxide (field test)—1.0 p.p.m.

STATION No. 21—SNARING RIVER at

2	July 23/52.....	8:12	46	8.0 (8.1)	0 (5)	3	167	104	0.141	36.4
---	-----------------	------	-------	-------	----	--------------	----------	---	-------	-------	-----	-----	-------	-------	------

STATION No. 22—ROCKY RIVER

3	July 23/52.....	8:12	46	8.1 (8.2)	0 (15)	60 (>50)	117	112	292	184	0.250	61.6
---	-----------------	------	-------	-------	----	--------------	-----------	-------------	-----	-----	-----	-----	-------	-------	------

* At bridge, east of Jasper, Alta.

STATION No. 23—MCLEOD RIVER

4	July 24/52.....	7:74	52	8.1 (8.3)	5 (15)	4 (5)	18	303	179	0.243	23.4
---	-----------------	------	-------	-------	----	--------------	-----------	----------	-------	----	-----	-----	-------	-------	------

STATION No. 24—EMBARRAS

5	July 24/52.....	7:14	56	8.0 (8.3)	40 (50)	2 <td>.....</td> <td>.....</td> <td>226</td> <td>160</td> <td>0.218</td> <td>.....</td> <td>31.6</td>	226	160	0.218	31.6
---	-----------------	------	-------	-------	----	--------------	------------	--	-------	-------	-----	-----	-------	-------	------

STATION No. 25—MCLEOD RIVER

6	Sept. 25/51.....	9:34	.....	.....	38	8.3	5	2	.....	.....	312	192	0.261	.....	72.2
7	July 25/52.....	6:13	.....	.....	56	8.1 (8.1)	40 (60)	9 (5)	.....	.....	226	132	0.180	.....	11.4

STATION No. 26—WOLF RIVER

8	July 25/52.....	6:13	58	7.8 (8.0)	60 (70)	13 (10)	25	193	142	0.193	35.8
---	-----------------	------	-------	-------	----	--------------	------------	------------	-------	----	-----	-----	-------	-------	------

STATION No. 27—MCLEOD RIVER

9	Sept. 27/51*.....	12:34	>normal†	.....	35	8.0	5	3	.....	.....	322	207	0.282	.....	81.6
10	Feb. 15/52.....	11:11	normal	.....	34	7.5	2	2	.....	.....	450	275	0.374	.....	30.8
11	Mar. 15.....	4:4	.....	.....	33	7.9	5	5	.....	.....	458	.....	.....	.....	.....
12	Apr. 15.....	11:14	.....	.....	34	7.7	40	85	380	360	208	145	0.197	.....	29.0

* Not included in average.

† Collector's estimate of river level or flow.

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(*In parts per million*)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂)	Hardness as CaCO ₃	Sum of constituents	Per cent sodium	Saturation index	No.	
		Sodium (Na)	Potassium (K)									Colorimetric						
canyon near JASPER, ALTA.																		
24.1	9.4	1.7	0.7	0.09	16.7	1.1	0.3	0.05	103	0	6.5	15.0	99.0	111	3.0	0.5	1
bridge east of JASPER, ALTA.																		
22.6	6.7	1.3	0.4	0.17	15.0	1.4	0.1	0.05	86.4	0	3.8 (3.2)	13.0	83.8	94.2	3.4	0.2	2
near POCAHONTAS*, ALTA.																		
41.7	12.3	1.1	0.4	0.05	37.0	2.3	0.2	.....	138	2.4	4.5	37.7	155	170	1.5	0.3	3
near CADOMIN, ALTA.																		
39.7	12.5	5.6	0.9	0.05	27.1	1.1	0.2	0.15	150	6.0	6.1	17.2	150	174	7.4	0.4	4
RIVER near WEALD, ALTA.																		
33.6	6.6	5.9	0.6	0.30	4.1	0.7	0.2	.....	139	2.4	11	0.0	111	134	10.3	0.1	5
at bridge, east of EDSON, ALTA.																		
47.1	10.5	9.1	0.7	0.06	14.8	1.0	0.1	0.10	187	3.8	7.8	0.6	161	187	10.9	0.7	6
33.1	7.7	4.7	0.6	0.12	6.9	0.4	0.2	.....	135	2.4	10	0.0	114	133	8.2	0.2	7
at bridge, east of EDSON, ALTA.																		
29.2	6.5	3.8	0.5	0.14	6.4	0.3	0.3	.....	121	0	10	0.4 (0.0)	99.8 (100)	117	7.6	0.2	8
at WHITECOURT, ALTA.																		
47.0	10.8	10.5	0.9	0.04	12.8	2.0	0.1	0.20	203	0	9.0	0	162	193	12.3	0.4	9
60.5	14.8	15.0	0.5	0.10	7.0	0.8	0.0	0.10	287	0	6.0	0	212	255	10
61.5	14.0	17.0	0.9	.....	14.0	0.4	0.6	.....	284	0	9.6	0	211	259	.....	.....	11
27.5	6.4	7.0	3.4	0.11	7.9	0.8	1.2	.....	133	0	9.7	0	95.4	129	.....	.....	12

TABLE II—Continued

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^4$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)		Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day

STATION No. 27—MCLEOD RIVER

1	May 15.....	6:15	low	.....	62	8.4	10	0.9	.....	.....	275	.....	.....	.....
2	June 15.....	9:10	high	.....	52	7.9	.....	350	133	123	171	147	0.200	.....
3	July 15.....	7:14	medium	.....	65	8.4	25	2	.....	.....	281	.....	.....	.....
4	July 28.....	9:14	.....	.....	67	8.1	45 (8.2)	8 (10)	23	20	241	.....	.....	.....
5	Aug.—Sample lost in transit.													
6	Sept. 15.....	9:14	medium	.....	57	8.2	30	3	.....	.....	277	.....	.....	.....
7	Oct. 15.....	6:17	low	.....	43	8.3	10	0.9	.....	.....	357	217	0.295	.....
8	Nov. 15.....	15:20	"	.....	33	8.3	20	5	.....	.....	418	.....	.....	.....
9	Dec. 16.....	20:38	"	.....	33	8.1	15	2	.....	.....	557	.....	.....	.....
10	Jan. 15/53.....	8:47	"	.....	33	8.0	15	3	.....	.....	605	302	0.411	49.6
11	Average..... (12 samples)	10:18	.....	.....	46	8.1	20	40	.....	.....	358	.....	.....	.....

STATION No. 28—FREEMAN RIVER at

12	July 30/52.....	7:12	63	7.7 (8.0)	80 (125)	8 (-)	25	22	156	125	0.170	38.0
----	-----------------	------	-------	-------	----	--------------	-------------	----------	----	----	-----	-----	-------	-------	------

STATION No. 29—PEMBINA RIVER

13	July 25/52.....	6:13	61	7.8 (8.0)	100 (125)	65 (>50)	123	174	150	0.204	45.4
----	-----------------	------	-------	-------	----	--------------	--------------	-------------	-------	-----	-----	-----	-------	-------	------

STATION No. 30—LOBSTICK RIVER at

14	July 25/52.....	6:13	63	7.5 (8.0)	150 (200)	20 (20)	36	181 (180)	168	0.228	60.0
----	-----------------	------	-------	-------	----	--------------	--------------	------------	-------	----	--------------	-----	-------	-------	------

STATION No. 31—PEMBINA RIVER

15	Sept. 27/51*.....	12:34	.....	.....	35	7.9	8	15	13	11	271	176	0.239	.....	53.6
16	Feb. 15/52.....	11:11	low†	.....	33	7.3	10	4	4.9	2.5	416	270	0.367	.....	56.6
17	Mar. 15.....	11:12	low	.....	33	7.7	20	7	.....	.....	449	.....	.....	.....	.....
18	Apr. 15.....	11:14	.....	.....	7.6	55	235	423	399	172	133	0.181	.....	39.2	.....

* Not included in average.

† Collector's estimate of level.

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂)	Hardness as CaCO ₃	Non-carbonate	Total	Sum of constituents	Per cent sodium	Saturation index		
		Sodium (Na)	Potassium (K)														+ | - | No.			
38.6	9.7	9.8	0.8	.....	6.6	3.0	trace	.....	.....	167	4.8	7.4	0	136	163	.....	.....	.....	1
24.9	5.7	4.7	1.1	0.10	9.0	0.2	0.1	0.60	.....	103	0	6.0	1.8	85.6	103	.....	.....	.....	2
40.5	9.7	7.0	0.8	.....	7.2	2.0	trace	.....	.....	166	4.8	10	0	141	164	.....	.....	.....	3
34.9	8.5	5.7	0.6	0.03	10.1	0.8	0.3	0.30	.....	146	2.4	13	0	122	148	.....	.....	.....	4
																			5	
40.4	8.5	6.6	0.7	.....	8.2	0.7	trace	.....	.....	162	5.5	10	0	136	160	.....	.....	.....	6
51.4	11.4	10.5	1.0	0.06	13.9	0.5	0.2	0.15	.....	210	9.6	11	0	175	213	.....	.....	.....	7
58.1	14.0	15.0	1.0	.....	12.6	0.4	0.3	.....	.....	253	9.1	5.6	0	203	241	.....	.....	.....	8
79.0	18.7	23.3	1.3	.....	18.7	0.9	0.2	.....	.....	363	6.0	10	0	274	337	.....	.....	.....	9
82.9	20.5	23.4	1.4	0.04	18.8	0.9	0.8	0.06	0.00	401	0	9.3	0	291	356	.....	.....	.....	10
50.0	11.8	12.2	1.1	.....	11.2	1.0	0.4	.....	.....	223	3.5	9.0	0	173	210	13.2	0.7	.....	11

at WHITECOURT, ALTA.

38.6	9.7	9.8	0.8	.....	6.6	3.0	trace	.....	.....	167	4.8	7.4	0	136	163	.....	.....	.....	1
24.9	5.7	4.7	1.1	0.10	9.0	0.2	0.1	0.60	.....	103	0	6.0	1.8	85.6	103	.....	.....	.....	2
40.5	9.7	7.0	0.8	.....	7.2	2.0	trace	.....	.....	166	4.8	10	0	141	164	.....	.....	.....	3
34.9	8.5	5.7	0.6	0.03	10.1	0.8	0.3	0.30	.....	146	2.4	13	0	122	148	.....	.....	.....	4
																			5
40.4	8.5	6.6	0.7	.....	8.2	0.7	trace	.....	.....	162	5.5	10	0	136	160	.....	.....	.....	6
51.4	11.4	10.5	1.0	0.06	13.9	0.5	0.2	0.15	.....	210	9.6	11	0	175	213	.....	.....	.....	7
58.1	14.0	15.0	1.0	.....	12.6	0.4	0.3	.....	.....	253	9.1	5.6	0	203	241	.....	.....	.....	8
79.0	18.7	23.3	1.3	.....	18.7	0.9	0.2	.....	.....	363	6.0	10	0	274	337	.....	.....	.....	9
82.9	20.5	23.4	1.4	0.04	18.8	0.9	0.8	0.06	0.00	401	0	9.3	0	291	356	.....	.....	.....	10
50.0	11.8	12.2	1.1	.....	11.2	1.0	0.4	.....	.....	223	3.5	9.0	0	173	210	13.2	0.7	.....	11

bridge, near FORT ASSINIBOINE, ALTA.

22.5	4.5	5.3	0.4	0.22	4.6	1.1	trace	92.4 (92.7)	0 (0)	12	0 (0)	74.8 (74.2)	95.6	13.3	0.5	12
------	-----	-----	-----	------	-----	-----	-------	-------	-------	----------------	----------	----	----------	----------------	------	------	-------	-----	----

at bridge at EVANSBURG, ALTA.

25.6	5.7	4.5	0.8	0.16	4.8	0.8	0.5	106	0	9.0	0.5	87.5	104	10.0	0.3	13
------	-----	-----	-----	------	-----	-----	-----	-------	-------	-----	---	-----	-----	------	-----	------	-------	-----	----

bridge, near EVANSBURG, ALTA.

22.5	6.4	8.6	2.3	0.19	8.2	1.8	1.2	107 (105)	0 (0)	6.5	0 (0)	82.6 (85.6)	111	18.0	0.6	14
------	-----	-----	-----	------	-----	-----	-----	-------	-------	--------------	----------	-----	----------	----------------	-----	------	-------	-----	----

near SANGUDO, ALTA.

37.1	9.0	11.3	1.3	0.05	6.9	1.2	0.6	0.30	.....	174	0	6.5	0	130	160	15.8	.....	0.1	15
53.1	13.3	18.0	2.1	0.11	9.8	1.6	0.0	0.00	.....	264	0	3.3	0	187	240	.....	.....	.....	16
55.4	14.0	19.0	2.0	.....	12.4	1.5	0.1	.....	.....	281	0	6.4	0	196	249	.....	.....	.....	17
22.0	4.5	7.0	3.9	0.24	7.5	1.1	1.4	.....	.....	103	0	6.7	0	73.3	105	.....	.....	.....	18

TABLE II—Continued

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^6$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)		Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day

STATION No. 31—PEMBINA RIVER

1	May 15.....	6:15	normal	.....	45	8.3	30	7	.....	.....	250	.....	.....	.....
2	June 15.....	18:22	high	.....	54	7.8	.....	.....	.....	.....	172	.....	.....	.....
3	July 15.....	14:15	normal	.....	54	7.7	.....	375	646	609	249	190	0.258	.....
4	July 28*	9:14	.....	.....	67	7.8 (8.2)	100 (125)	35 (50)	76	69	192	155	0.211	.....
5	Aug. 16.....	13:20	normal	.....	62	8.0	40	6	.....	12	247	179	0.243	.....
6	Sept. 17.....	7:12	"	.....	55	8.0	45	10	.....	.....	243	.....	.....	.....
7	Oct. 16.....	15:40	"	.....	43	7.9	30	15	21	13	304	195	0.265	.....
8	Nov. 15.....	12:20	low	.....	33	8.0	35	8	.....	.....	341	.....	.....	.....
9	Dec. 16.....	20:44	"	.....	32	8.0	40	15	.....	.....	445	.....	.....	.....
10	Jan. 15/53.....	11:44	"	.....	33	7.8	50	20	10.3	5.3	472	318	0.432	.....
11	Average..... (12 samples)	12:22	.....	.....	43	7.8	35	65	.....	.....	313	.....	.....	70.8

* Not included in average.

STATION No. 32—PADDLE RIVER

12	July 30/52.....	7:12	69	7.9 (8.3)	150 (250)	10 (10)	17	14	362	281	0.382	79.2
----	-----------------	------	-------	-------	----	--------------	--------------	------------	----	----	-----	-----	-------	-------	------

STATION No. 33—PEMBINA RIVER

13	July 30/52.....	7:12	71	7.8 (8.0)	85 (>50)	200	178	211	184	0.250	74.4
----	-----------------	------	-------	-------	----	--------------	-------	-------------	-----	-----	-----	-----	-------	-------	------

STATION No. 34—WEST PRAIRIE RIVER

14	Aug. 7/52.....	13:18	73	7.5 (7.8)	240 (350)	10 (10)	15	12	218	211	0.287	85.2
----	----------------	-------	-------	-------	----	--------------	--------------	------------	----	----	-----	-----	-------	-------	------

STATION No. 35—LESSER SLAVE

15	Oct. 7/51.....	12:32	Water elevation in feet 1,891.41	48	7.7 (7.9)	5 (25)	2 <td>.....</td> <td>.....</td> <td>252</td> <td>166</td> <td>0.226</td> <td>.....</td> <td>52.2</td>	252	166	0.226	52.2
16	July 31/52.....	7:13	no record	72	7.8 (8.4)	30 (50)	6 (7)	222	146	0.199	54.8

† Sampled from wharf. Maximum water elevation—1,891.91, Aug. 6/51; minimum water elevation—1,891.40 at various times in Sept. and Oct./51.

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(*In parts per million*)

Calcium (Ca)	Magnesium (Mg)	Alkalies				Iron (Fe)	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂)	Hardness as CaCO ₃		Sum of constituents	Per cent sodium	Saturation index	No.
		Sodium (Na)	Potassium (K)	Dissolved											Colorimetric	Non-carbonate	Total			
33.0	8.2	10.4	1.4	4.1	3.0	trace	158	0	6.0	0	110	144	1
27.7	4.9	5.4	2.4	7.4	2.3	0.4	103	0	6.4	5.3	89.3	107	2
35.1	8.0	8.1	1.6	0.11	8.1	0.9	1.2	0.20	155	0	9.4	0	121	149	3
28.5	5.6	5.7	1.1	0.23	5.7	2.3	0.6	117	0	10.5	0	94.0	118	4
35.4	7.4	7.3	1.3	0.05	5.6	0.5	0.5	.....	0.00	149	2.9	11	0	119	144	.....	.....	.....	5
34.5	7.6	7.9	1.2	.....	4.5	0.7	0.4	.....	.....	147	3.6	9.0	0	117	142	.....	.....	.....	6
40.4	9.7	11.0	1.8	0.03	7.2	1.1	1.2	.....	.....	191	0	8.2	0	141	175	.....	.....	.....	7
44.4	10.8	14.0	2.0	.....	8.0	1.1	0.8	.....	.....	207	2.9	9.1	0	155	195	.....	.....	.....	8
58.9	14.1	17.7	2.3	.....	6.4	1.1	0.5	.....	.....	288	0	18	0	205	261	.....	.....	.....	9
60.8	14.8	20.9	4.2	0.03	12.9	3.2	4.0	.....	0.01	302	0	16	0	213	285	.....	.....	.....	10
41.7	9.8	12.2	2.2	.....	7.8	1.5	1.0	.....	.....	191	0.8	9.1	0	144	180	15.3	0.2	.....	11

near SANGUDO, ALTA.

33.0	8.2	10.4	1.4	.....	4.1	3.0	trace	.....	.....	158	0	6.0	0	110	144	.....	.....	.....	1
27.7	4.9	5.4	2.4	.....	7.4	2.3	0.4	.....	.....	103	0	6.4	5.3	89.3	107	.....	.....	.....	2
35.1	8.0	8.1	1.6	0.11	8.1	0.9	1.2	0.20	.....	155	0	9.4	0	121	149	.....	.....	.....	3
28.5	5.6	5.7	1.1	0.23	5.7	2.3	0.6	.....	.....	117	0	10.5	0	94.0	118	.....	.....	.....	4
35.4	7.4	7.3	1.3	0.05	5.6	0.5	0.5	.....	0.00	149	2.9	11	0	119	144	.....	.....	.....	5
34.5	7.6	7.9	1.2	.....	4.5	0.7	0.4	.....	.....	147	3.6	9.0	0	117	142	.....	.....	.....	6
40.4	9.7	11.0	1.8	0.03	7.2	1.1	1.2	.....	.....	191	0	8.2	0	141	175	.....	.....	.....	7
44.4	10.8	14.0	2.0	.....	8.0	1.1	0.8	.....	.....	207	2.9	9.1	0	155	195	.....	.....	.....	8
58.9	14.1	17.7	2.3	.....	6.4	1.1	0.5	.....	.....	288	0	18	0	205	261	.....	.....	.....	9
60.8	14.8	20.9	4.2	0.03	12.9	3.2	4.0	.....	0.01	302	0	16	0	213	285	.....	.....	.....	10
41.7	9.8	12.2	2.2	.....	7.8	1.5	1.0	.....	.....	191	0.8	9.1	0	144	180	15.3	0.2	.....	11

at BARRHEAD, ALTA.

44.3	12.3	19.0	3.6	0.39	17.9	3.2	1.4	221	0	11	0	181	222	20.0	0.3	12
------	------	------	-----	------	------	-----	-----	-------	-------	-----	---	----	---	-----	-----	------	-----	-------	----

at bridge at JARVIE, ALTA.

29.0	6.8	7.1	1.8	0.25	11.2	2.0	0.6	124	0	11	0	100	131	13.1	0.2	13
------	-----	-----	-----	------	------	-----	-----	-------	-------	-----	---	----	---	-----	-----	------	-----	----

at bridge at HIGH PRAIRIE, ALTA.

32.0	5.7	8.7	1.8	0.77	18.7	1.8	0.8	114	0	14	10.4	103	140	15.2	0.4	14
------	-----	-----	-----	------	------	-----	-----	-------	-------	-----	---	----	------	-----	-----	------	-----	----

LAKE† at FAUST, ALTA.

29.0	8.9	10.3	5.4	0.09	29.5	2.9	2.0	0.20	.....	118	0	1.1	12.0	109	148	16.4	0.3	15
23.6	8.2	8.8	4.1	0.11	30.3	1.0	0.0	0.40	.....	104	0	3.8	7.8	92.8	131	16.4	0.3	16

TABLE II—Continued

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^4$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)		Loss on ignition at 550°C.	
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day	

STATION No. 36—SWAN RIVER

1	July 31/52.....	7:13	65	7.3 (7.5)	140 (200)	20	53	49	126	136	0.185	63.2
---	-----------------	------	-------	-------	----	--------------	--------------	----	----	----	-----	-----	-------	-------	------

STATION No. 37—LESSER SLAVE RIVER

2	Oct. 7/51.....	12:32	.....	.....	47	7.6 (8.4)	2 (25)	10 (10)	14	9.6	186	119	0.162	.....	29.8
3	July 30/52.....	8:14	.....	.....	68	7.9 (8.1)	20 (30)	4 (7)	15	14	186	126	0.171	.....	38.2

STATION No. 38—FAWCETT RIVER

4	Aug. 7/52.....	13:26	70	7.8 (8.4)	60 (100)	1.2 (1.5)	134	116	0.158	43.8
---	----------------	-------	-------	-------	----	--------------	-------------	--------------	-------	-------	-----	-----	-------	-------	------

STATION No. 39—LAC LA BICHE

5	Aug. 8/52.....	13:25	Water elevation in feet		69	8.0 (8.6)	10 (25)	3 (algae)	302	204	0.277	47.8
---	----------------	-------	-------------------------	--	----	--------------	------------	--------------	-------	-------	-----	-----	-------	-------	------

† Gauge zero—91.44.

STATION No. 40—WOLLASTON LAKE

6	Aug. 12/53.....	13:96	Water elevation in feet		65	7.9	5	3	35.4
---	-----------------	-------	-------------------------	--	----	-----	---	---	-------	-------	------	-------	-------	-------	-------

* Record at Trading Post.

STATION No. 41—PEACE RIVER above junction

7	Aug. 2/52.....	10:13	49,500†	68	8.0 (8.1)	20 (15)	15 (15)	185
---	----------------	-------	---------	-------	----	--------------	------------	------------	-------	-------	-----	-------	-------	-------	-------

†† Record at Hudson Hope.

STATION No. 42—HALFWAY RIVER

8	Aug. 2/52.....	10:17	63	8.2 (8.2)	25 (30)	35 (35)	64	53	336	209	0.284	19.8
---	----------------	-------	-------	-------	----	--------------	------------	------------	----	----	-----	-----	-------	-------	------

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂)	Hardness as CaCO ₃	Sum of constituents	Per cent sodium	Saturation index	No.
		Sodium (Na) ^a	Potassium (K)														

at bridge at KINUSO, ALTA.

15.9	3.7	3.6	1.9	1.0	6.0	0.7	0.2	69.5	0	18	0.0	55.0	85.2	12.0	1.1	1
------	-----	-----	-----	-----	-----	-----	-----	-------	-------	------	---	----	-----	------	------	------	-------	-----	---

at bridge near SLAVE LAKE, ALTA.

22.8	5.2	7.6	3.1	0.03	13.0	0.7	0.4	0.10	102	0	1.0	0.0	77.9	104	16.8	0.6	2	
21.8	5.8	7.7	3.2	0.05	14.5	0.6	0.3	0.30	97.1	0	(1)	(5.6)	(82.6)	78.1	104	16.9	0.3	3

at bridge near SMITH, ALTA.

18.0	3.7	4.8	2.2	0.16	8.7	0.8	0.8	76.4	0	4.5	0.0	60.0	81.3	14.2	0.5	4
------	-----	-----	-----	------	-----	-----	-----	-------	-------	------	---	-----	-----	------	------	------	-------	-----	---

at LAC LA BICHE, ALTA.

34.8	11.4	13.0	3.3	0.07	11.7	3.2	1.8	0.10	173	2.4	11	0.0	134	179	17.0	0.3	5
------	------	------	-----	------	------	-----	-----	------	-------	-----	-----	----	-----	-----	-----	------	-----	-------	---

near north end in SASKATCHEWAN.

2.6	1.8	2.5	0.06	5.8	0.4	0.8	19.5	0	0.0	138	1.9	6
-----	-----	-------	-----	------	-----	-----	-----	-------	-------	------	---	-------	-----	-----	-------	-------	-----	---

with HALFWAY RIVER near ATTACHIE, B.C.

27.2	6.2	1.4	0.4	12.3	0.2	0.0	0.20	96.4 (96.4)	1.2 (1.2)	6.7	12.3	93.3 (99.1)	103	3.1	0.1	7
------	-----	-----	-----	-------	------	-----	-----	------	-------	----------------	--------------	-----	------	----------------	-----	-----	-------	-----	---

near mouth, near ATTACHIE, B.C.

50.5	13.4	2.2	0.6	0.11	28.6	0.9	0.1	0.20	173	7.2	4.6	27.2	181	194	2.6	0.7	8
------	------	-----	-----	------	------	-----	-----	------	-------	-----	-----	-----	------	-----	-----	-----	-----	-------	---

TABLE II—Continued

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^4$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)			Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day	

STATION No. 43—PINE RIVER

1	Apr. 5/52.....	28:33			40	7.9	10	65	150	143	240	152	0.207	.....	21.8
2	May 2.....	19:20			38	8.1	15	0.6	.....	.....	280	169	0.230	.....	42.0
3	June—No sample taken.														
4	July 1.....	28:45	no		46	7.9	25	30	.....	198	.....	.....	.....	.....
5	Aug. 4†.....	10:15	discharge		63	8.1	10	10	18	12	261	155	0.211	.....	46.4
6	Sept. 4.....	28:42	records		42	8.2	5	.....	.....	286	.....	.....	.....	.....
7	Oct.—No sample taken.														
8	Nov. 1.....	76:95			36	8.5	10	4	5.6	3.5	297	178	0.242	.....	15.6
9	Dec. 1.....	46:71			32	8.6	15	.....	.....	341	.....	.....	.....	.....
10	Jan. 1/53.....	15:40			34	8.1	15	7	.....	301	.....	.....	.....	.....
11	Average..... (8 samples)	31:76			41	8.2	13	20	.....	276	.....	.....	.....	.....

† Above junction with Murray River.

STATION No. 44—MURRAY

12	May 15/52.....	6:7			38	7.9	25	310	590	552	208	138	0.188	.....	52.2
13	June—No sample taken.														
14	July 1.....	28:45	no		46	7.9	.....	15	.....	101	.....	.....	.....	.....
15	Aug. 4†.....	10:15	discharge		65	8.1 (8.1)	40 (25)	90 (>50)	167	146	215 (220)	136	0.185	.....	24.8
16	Sept. 18.....	14:15	records		42	8.1	10	6	.....	244	.....	.....	.....	.....
17	Oct. 1.....	17:27			34	8.0	10	1	.....	253	.....	.....	.....	.....
18	Nov. 1.....	76:95			36	7.9	40	7	4.7	2.8	247	149	0.203	.....	20.2
19	Dec. 1.....	46:71			32	8.3	10	3	.....	363	.....	.....	.....	.....
20	Jan. 1/53.....	19:47			33	7.6	15	10	.....	316	.....	.....	.....	.....
21	Average..... (8 samples)	27:40			41	8.0	20	55	.....	255	.....	.....	.....	.....

† Above junction with Pine River.

STATION No. 45—PEACE RIVER near TAYLOR,

22	Oct. 5/51†.....	11:31	.....	12,000	47	8.0 (8.4)	2 (15)	5 (5)	3.4	1.7	246	147	0.200	.....	28.8
23	Aug. 2/52†.....	12:17	60,900	42,400	67	7.8 (8.1)	10 (15)	20 (15)	38	30	206	125	0.170	20,462	47.6
24	Aug. 16.....	13:20	41,200	42,400	60	8.0	5	15	.....	23	213	131	0.178	14,502	11.6

† Not included in average; sampled from highway bridge; ice conditions Oct. 23/51 to May 9/52; Nov. 12/52 to May 4/53.

† Sampled from north shore; not included in average.

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂) Colorimetric	Hardness as CaCO ₃	Sum of constituents	Per cent sodium	Saturation index			No.
		Sodium (Na)	Potassium (K)													+ | -			

at EAST PINE, B.C.

37.7	8.4	2.3	0.5	0.16	5.6	1.4	1.8	.....	.....	148	0	4.1	7.6	129	135	.....	.....	1
40.4	10.7	2.8	0.9	0.13	16.0	2.7	0.6	0.20	.....	168	0	3.3	6.8	145	161	.....	.....	2
																		3
30.5	6.3	1.3	0.3	.....	6.6	0.4	0.1	0.10	0.02	115	1.2	4.6	5.3	102	108	.....	.....	4
40.3	8.9	1.8	0.7	0.07	13.6	1.1	0.1	0.10	.....	149	3.6	4.1	9.2	137	148	.....	.....	5
44.5	8.9	2.3	0.4	.....	16.7	1.4	0.1	.....	.....	156	4.1	4.8	12.7	148	160	.....	.....	6
																		7
45.2	10.5	2.4	0.7	0.03	18.7	1.7	0.6	0.10	0.04	161	7.2	5.1	12.5	156	171	.....	.....	8
48.0	12.0	3.7	0.5	.....	23.5	1.8	0.4	.....	.....	173	8.4	5.2	13.4	169	189	.....	.....	9
49.4	10.6	3.2	0.9	.....	20.4	2.1	0.4	.....	.....	190	0	4.3	11.0	167	185	.....	.....	10
42.0	9.5	2.5	0.6	.....	15.1	1.6	0.5	.....	.....	158	3.1	4.4	9.3	144	157	3.6	0.5	11

RIVER at EAST PINE, B.C.

30.6	7.5	2.3	1.8	0.28	9.2	3.5	1.2	0.10	.....	124	0	2.8	5.8	107	135	.....	.....	12
																		13
28.2	7.0	1.3	0.4	.....	7.4	0.5	0.6	0.10	0.00	114	0	4.3	6.0	99.0	106	.....	.....	14
31.2	8.0	1.9	0.9	0.41	14.3	0.9	0.1	.....	.....	119	2.4	3.6	9.0	111 (114)	122	.....	.....	15
36.0	8.3	2.2	0.5	.....	14.6	0.7	0.4	.....	.....	131	2.9	3.7	11.6	124	134	.....	.....	16
39.0	7.7	2.4	0.6	.....	13.9	1.4	0.4	.....	.....	151	0	2.7	5.0	129	143	.....	.....	17
36.8	7.9	3.0	1.0	0.07	15.7	1.3	0.5	.....	.....	142	0	3.6	7.8	124	140	.....	.....	18
55.1	12.9	3.5	0.6	.....	22.2	1.8	0.2	.....	.....	199	7.7	5.2	14.5	191	207	.....	.....	19
48.4	10.5	3.4	0.7	.....	17.7	1.6	1.2	.....	.....	185	0	4.4	12.8	164	179	.....	.....	20
38.2	8.7	2.5	0.8	.....	14.4	1.5	0.6	.....	.....	146	1.6	3.8	9.0	131	144	4.0	0.3	21

B.C.—Drainage area, 38,300 square miles

38.0	9.0	1.9	1.0	0.04	18.4	1.6 (1.3)	0.0	0.00	.....	144	0	5.5 (5)	16.1 (135)	134	148	3.0	0.2	22
29.7	7.1	2.0	0.9	0.05	17.6	1.4	0.1	0.05	.....	111	0	5.8	12.4	103	119	.....	.....	23
31.0	7.2	1.5	0.6	0.04	17.5	0.2	trace	0.10	0.00	110	2.4	6.1	15.2	109	122	.....	.....	24

TABLE II—Continued

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^6$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)			Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day	

STATION No. 45—PEACE RIVER

1	Sept. 16.....	8:22	25,100	30,100	50	8.1	5	4	7.3	6.1	223	133	0.181	8,986	8.2
2	Oct. 16.....	13:29	30,200	33,300	40	8.0	5	5	.....	.....	206	.....	.....	.....	.....
3	Nov. 2††.....	11:26	23,900	14,700	36	7.7	10	3	.....	.....	207	126	0.171	8,102	45.4
4	Nov. 16.....	12:19	13,300	14,700	33	8.1	10	2	.....	.....	214	.....	.....	.....	.....
5	Dec. 16.....	20:56	5,200	5,400	32	8.2	10	3	.....	.....	245	.....	.....	.....	.....
6	Jan. 16/53.....	10:45	8,900	8,480	32	8.1	10	3	.....	.....	251	148	0.201	3,542	13.2
7	Feb. 16.....	11:39	7,500	7,640	32	8.2	7	1	.....	.....	257	.....	.....	.....	.....
8	Mar. 16.....	9:08	7,050	7,050	32	8.1	10	0	0	0	260	150	0.216	3,017	11.4
9	Apr.—No sample taken.....	.....	.....	10,600	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
10	May 22.....	20:21	283,300	160,000	43	8.0	50	300	285	269	176	117	0.159	89,240	31.6
11	Average..... (9 samples)	13:35	46,855	34,341	39	8.1	12	37	.....	.....	227	.....	.....	.....	.....

†† Sampled from north shore; not included in average.

STATION No. 46—BEATTON RIVER at

12	Aug. 2/52.....	10:17	71	7.6 (8.0)	500	434	378	234	230	0.313	73.8
----	----------------	-------	-------	-------	----	--------------	-------	-----	-----	-----	-----	-----	-------	-------	------

STATION No. 47—KISKATINAW RIVER

13	Feb. 18/52.....	15:15	.....	.....	37	8.2	8	6	5.4	4.1	596	350	0.476	.....	36.0
14	Mar. 14.....	12:13	.....	.....	36	7.8	15	6	.....	.....	608	.....	.....	.....	.....
15	Apr. 18.....	15:20	flood††	no	37	7.9	.....	900	1,039	963	181	219	0.298	.....	48.8
16	May 16.....	13:14	normal	discharge	55	8.2	.....	5	.....	.....	267	.....	.....	.....	.....
17	June 17.....	9:20	"	records	56	8.0	.....	1,300	.....	.....	265	.....	.....	.....	.....
18	July 22.....	7:8	"	.....	60	7.6	.....	80	11.4	7.0	390	268	0.364	.....	64.4
19	Aug. 4†.....	10:36	.....	.....	70	8.3 (8.2)	50 (50)	30 (50)	.....	.....	350	.....	.....	.....	.....
20	Aug. 15.....	11:25	normal	.....	62	7.7	60	15	.....	.....	397	.....	.....	.....	.....
21	Sept. 18.....	9:15	> "	.....	54	8.1	60	25	.....	.....	391	.....	.....	.....	.....
22	Oct. 17.....	12:15	normal††	.....	43	8.3	35	15	15	11	450	279	0.379	.....	39.0
23	Nov. 18.....	9:17	"	.....	38	8.3	40	20	.....	.....	526	.....	.....	.....	.....

† From highway bridge, east of Dawson Creek—heavy rain; not included in average.

†† Collector's estimate of river flow or level.

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(*In parts per million*)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe)	Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂)	Hardness as CaCO ₃			Sum of constituents	Per cent sodium	Saturation index	No.
		Sodium (Na)	Potassium (K)											Colorimetric	Non-carbonate	Total				
near TAYLOR, B.C.—Concluded																				
33.6	7.6	1.6	0.4	0.02	19.0	1.0	0.1	0.05	.....	117	2.4	8.4	15.2	115	132	.....	.....	.....	1
30.0	7.0	1.4	0.5	.....	16.9	0.2	0.3	.....	.....	110	0	4.9	13.6	104	115	.....	.....	.....	2
30.3	7.3	1.5	0.4	0.05	17.4	0.6	0.3	0.10	0.00	112	0	5.4	13.8	106	119	.....	.....	.....	3
31.0	7.0	1.8	0.5	.....	16.7	0.3	0.4	.....	.....	103	6.0	4.6	11.7	106	119	.....	.....	.....	4
36.0	8.4	2.0	0.5	.....	17.8	0.4	0.4	.....	.....	137	0	7.9	12.3	124	142	.....	.....	.....	5
36.8	8.7	1.8	0.5	0.05	16.9	0.5	0.5	0.05	.....	141	0	6.7	12.4	128	142	.....	.....	.....	6
37.0	9.2	1.8	0.4	.....	18.1	0.3	0.8	.....	.....	142	0	6.9	14.4	130	144	.....	.....	.....	7
38.1	9.8	3.5	1.8	0.07	17.8	0.3	0.6	0.00	0.00	146	0	11	13.2	133	155	.....	.....	.....	8
																			9	
28.9	5.2	2.2	0.6	0.36	8.1	0.1	0.6	.....	0.00	109	0	.....	4.0	93.6	99.9	.....	.....	.....	10
33.7	7.7	2.0	0.6	.....	16.5	0.4	0.4	.....	.....	124	1.2	7.1	12.4	116	131	3.6	0.2	.....	11

bridge near FORT ST. JOHN, B.C.

25.4	7.4	14.3	2.0	1.1	51.2	2.6	trace	0.00	83.0 (85.4)	0 (0)	5.3	25.7 (24.0)	93.7 (94.0)	150	24.4	0.6	12
------	-----	------	-----	-----	------	-----	-------	-------	------	----------------	----------	-----	----------------	----------------	-----	------	-------	-----	----

near DAWSON CREEK, B.C.

93.8	22.2	10.8	0.8	0.02	18.6	0.9	0.3	0.10	.....	383	8.4	7.9	0.3	325	353	.....	.....	.....	13
88.5	22.0	12.3	0.6	.....	26.3	0.8	0.0	.....	.....	384	0	6.9	0.0	311	347	.....	.....	.....	14
31.4	3.5	1.6	6.8	4.2	7.7	2.1	0.4	.....	.....	115	0	.....	0.0	93.0	114	.....	.....	.....	15
40.3	8.7	4.3	1.0	.....	6.6	1.0	.....	.....	.....	162	2.4	.....	0.0	136	149	.....	.....	.....	16
39.8	9.5	4.3	1.4	.....	6.5	2.5	0.4	.....	.....	166	0	6.2	2.1	139	153	.....	.....	.....	17
58.5	14.1	6.9	1.7	0.14	30.2	2.9	0.4	0.20	.....	227	0	5.6	17.9	204	234	.....	.....	.....	18
54.1	13.2	5.8	0.8	.....	9.8	1.0	0.6	.....	.....	218	6.7	6.3	0.0	189	206	.....	.....	.....	19
60.5	14.5	6.2	1.1	.....	9.0	2.2	0.2	.....	.....	256	0	7.2	0.6	211	227	.....	.....	.....	20
61.3	14.4	6.4	1.0	.....	8.8	0.7	0.5	.....	.....	244	6.0	5.0	1.9	212	224	.....	.....	.....	21
66.6	17.0	7.9	1.2	0.07	14.5	1.3	0.3	.....	.....	263	15.1	7.0	0.0	236	261	.....	.....	.....	22
79.4	19.6	10.5	1.2	.....	15.6	0.6	0.2	.....	.....	330	11.3	6.8	0.0	279	308	.....	.....	.....	23

TABLE II—Continued

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^6$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)		Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day

STATION No. 47—KISKATINAW RIVER

1	Dec. 17.....	19:43	low	.....	38	8.1	25	25	.....	.....	708	.....	.....	.....
2	Jan. 16/53.....	12:43	"	.....	35	8.1	20	15	12	8.3	972	584	0.794	92.4
3	Average..... (12 samples)	12:21	.....	.....	46	8.0	.....	200	.....	.....	479	.....	.....	.....

STATION No. 48—KISKATINAW RIVER

4	Oct. 5/51.....	11:31	41	8.4 (8.3)	5	15	14.1	7.4	426	276	0.375	59.6
---	----------------	-------	-------	-------	----	--------------	---	----	------	-----	-----	-----	-------	------

STATION No. 49—POUCE COUPÉ

5	Aug. 1/52.....	11:18	68	7.7 (8.1)	150	10 (10)	18	12	313 (310)	258	0.351	82.4
---	----------------	-------	-------	-------	----	--------------	-----	------------	----	----	--------------	-----	-------	------

STATION No. 50—PEACE RIVER

6	Oct. 4/51.....	12:32	.....	.....	44	8.0 (8.2)	2 (15)	7 (clear)	1.7	1.5	310	195	0.265	13.2
7	Aug. 5/52.....	14:16	.....	.....	68	8.1 (8.2)	10 (25)	25 (35)	41	37	195	119	0.162	42.6

STATION No. 51—WAPITI RIVER at

8	Aug. 1/52.....	11:12	68	8.2 (8.5)	15	4 (5)	9.4	7.5	256	151	0.205	43.2
---	----------------	-------	-------	-------	----	--------------	----	----------	-----	-----	-----	-----	-------	------

STATION No. 52—BEAR RIVER

9	Oct. 4/51	12:32	44	7.7 (8.0)	25	4 (15)	19	13	255	205	0.279	60.0
---	-----------	-------	-------	-------	----	--------------	----	-----------	----	----	-----	-----	-------	------

STATION No. 53—SMOKY RIVER

10	Oct. 6/51*.....	13:33	.....	no	46	8.1 (8.4)	5 (25)	10 (7)	10.7	7.3	294	179	0.243	32.0
11	Feb. 18/52.....	15:15	very low†	discharge	34	7.7	2	3	.....	.....	451	287	0.390	20.4
12	Mar. 17.....	9:10	low	records	33	7.7	5	2	.....	.....	483	.....	.....	.....
13	Apr. 18.....	15:20	>normal		35	7.8	40	910	1,809	1,898	198	158	0.215	34.4
14	May 21.....	8:28	"		52	7.9	.....	150	.....	.....	185	.....	.....	.....

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(*In parts per million*)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂) Colorimetric	Hardness as CaCO ₃		Sum of constituents	Per cent sodium	Saturation index	No.
		Sodium (Na)	Potassium (K)										Non-carbonate	Total				
near DAWSON CREEK, B.C.—Concluded																		
107	26.9	14.6	1.4	.....	9.3	0.5	0.1	.....	.....	488	0	9.2	0.0	378	409	.....	.....	1
149	40.9	19.2	1.7	0.02	27.7	0.8	0.4	0.00	.....	697	0	11	0.0	540	593	.....	.....	2
73.0	17.8	8.8	1.7	.....	15.0	1.4	2.9	.....	.....	310	3.6	7.2	0.0	255	284	6.9	0.8	3

at bridge near SWEETWATER, B.C.

59.6	17.5	9.6	1.6	0.04	21.4	0.6	0.0	0.10	248	11.3	4.1 (4)	0.0	221	248	8.6	1.0	4
------	------	-----	-----	------	------	-----	-----	------	-------	-----	------	------------	-----	-----	-----	-----	-----	---

RIVER near POUCE COUPE, B.C.

40.5	11.4	10.1	2.8	0.42	49.1	1.9	1.0	134	0 (132)	6.1 (0)	38.3 (41.0)	148 (149)	189	12.7	0.1	5
------	------	------	-----	------	------	-----	-----	-------	-------	-----	------------	------------	----------------	--------------	-----	------	-------	-----	---

from ferry at DUNVEGAN, ALTA.

45.5	10.3	6.8	1.2	0.02	38.7	1.9	0.0	0.00	.....	151	0	5.4 (5)	32.1	156	184	8.6	0.3	6
29.2	6.4	1.6	0.6	0.14	14.6	1.5	0.0	0.10	.....	104 (105)	2.4	4.7	10.4	99.4	112	3.4	0.1	7

ferry near GRANDE PRAIRIE, ALTA.

38.2	9.0	3.6	0.7	0.05	17.0	0.9	0.1	0.20	137	4.8	4.4	12.3	132	146	5.5	0.4	8
------	-----	-----	-----	------	------	-----	-----	------	-------	-----	-----	-----	------	-----	-----	-----	-----	---

near GRANDE PRAIRIE, ALTA.

24.8	7.0	15.0	7.3	0.28	42.8	1.3	0.8	0.30	102	0	4.2	7.1	90.7	147	24.6	0.5	9
------	-----	------	-----	------	------	-----	-----	------	-------	-----	---	-----	-----	------	-----	------	-------	-----	---

near GRANDE PRAIRIE, ALTA.

44.1	10.9	5.1	0.4	0.05	28.6	0.5	0.2	0.30	.....	157	1.9	4.1	23.3	155	173	6.7	0.4	10
66.3	16.4	7.5	0.7	0.07	73.3	1.5	0.2	0.20	.....	210	0	4.1	60.9	233	274	.....	.....	11
66.5	17.0	8.8	0.4	.....	76.1	1.1	0.0	.....	.....	217	0	5.2	57.8	236	282	.....	.....	12
31.9	5.3	4.0	4.2	0.84	15.6	1.4	1.6	.....	.....	114	0	.....	8.0	101	121	.....	.....	13
26.2	6.4	2.0	0.9	.....	11.9	0.8	.....	0.05	.....	101	0	4.0	8.7	91.7	103	.....	.....	14

TABLE II—Continued

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^6$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)			Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day	

STATION No. 53—SMOKY RIVER near

1	June 17/52.....	7:8	high	no	50	8.0	.....	70	103	96	207	136	0.185	.....	29.0
2	July 18.....	11:12	normal	discharge	64	7.9	15	35	46	44	233	147	0.200	.....	38.0
3	July 31*.....	7:13	.....	records	70	8.2	30	35	49	44	237	152	0.207	.....	41.6
4	Aug. 17.....	12:23	low	.....	64	8.1	10	25	.....	.....	256	.....	.....	.....	.....
5	Sept. 19.....	9:15	"	.....	50	8.1	10	7	.....	.....	308	.....	.....	.....	.....
6	Oct. 17.....	12:15	"	.....	44	8.1	5	4	4.8	2.7	309	181	0.246	.....	16.4
7	Nov. 18.....	9:17	"	.....	33	8.1	10	2	.....	.....	390	.....	.....	.....	.....
8	Dec. 19.....	18:53	"	.....	32	8.4	10	2	.....	.....	528	.....	.....	.....	.....
9	Jan. 29/53.....	8:42	"	.....	32	8.0	3	3	.....	.....	439	281	0.382	.....	21.8
10	Average.....	11:22	.....	.....	44	8.0	11	100	.....	.....	332	.....	.....	.....	.....
	(12 samples)														

* Not included in average.

† Collector's estimate of river flow or level.

STATION No. 54—LITTLE SMOKY RIVER

11	Oct. 6/51.....	-33	.....	.....	48	8.2 (8.1)	15 (40)	9 (10)	5.9	2.3	311	198	0.269	.....	63.0
12	July 31/52.....	13:19	.....	.....	75	7.6 (8.1)	140 (170)	50 (50)	82	73	173	.....	.....	.....	.....

STATION No. 55—SMOKY RIVER

13	Aug. 7/52.....	13:18	70	8.1 (8.2)	40 (50)	75 (50)	52	41	244	158	0.215	9.2
----	----------------	-------	-------	-------	----	--------------	------------	------------	----	----	-----	-----	-------	-------	-----

STATION No. 56—PEACE RIVER

14	Oct. 3/51*.....	13:33	.....	12,900†	47	8.2 (8.2)	5 (20)	20 (10)	7.5	6.6	326	203	0.276	.....	20.4
15	Feb. 23/52.....	10:10	6,300†	6,550	34	8.0	2	1	.....	.....	326	193	0.262	3,270	21.0
16	Mar. 24.....	14:30	6,000	6,100	35	8.0	5	2	.....	.....	299	.....	.....	.....	.....
17	Apr. 21.....	12:17	10,900	9,700	35	7.6	.....	1,500	.....	.....	268	.....	.....	.....	.....
18	May 20.....	9:17	182,000	106,000	50	7.7	.....	335	654	618	165	118	0.160	57,694	25.0
19	June—No sample taken.....	.....	161,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
20	July—No sample taken.....	.....	105,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
21	Aug. 6†.....	13:19	53,500	42,400	69	8.1 (8.0)	10 (25)	25 (35)	44	34	206 (210)	128	0.174	18,404	26.2

* From south bank below town intake; not included in average.

† From north shore at bridge.

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂) Colorimetric	Hardness as CaCO ₃		Sum of constituents	Per cent sodium	Saturation index	No.
		Sodium (Na)	Potassium (K)										Non-carbonate	Total				

GRANDE PRAIRIE, ALTA.—Concluded

28.9	8.0	3.2	0.6	0.20	13.1	1.7	0.2	0.20	0.07	113	0	3.4	12.4	105	115	.....	1
33.3	8.5	3.2	0.5	0.08	21.4	0.5	0.2	.....	.....	122	1.2	4.4	16.0	118	133	.....	2
34.3	8.5	3.2	0.9	0.17	24.2	0.4	0.1	0.20	.....	118	3.1	3.6	18.4 (14.0)	120 (122)	137	.....	3
37.0	8.6	3.5	0.4	.....	27.1	0.4	0.2	.....	.....	120	4.6	3.3	21.7	128	144	.....	4
43.5	11.2	4.7	0.8	.....	38.1	0.1	0.2	.....	.....	146	3.1	3.3	29.7	155	177	.....	5
41.7	11.0	4.2	0.7	0.01	38.5	0.8	trace	0.10	.....	142	4.8	4.1	25.3	149	176	.....	6
53.1	14.1	7.0	1.0	.....	54.7	0.8	0.2	.....	.....	189	0	3.7	35.2	190	228	.....	7
75.7	20.4	8.0	0.8	.....	90.1	1.0	0.2	.....	.....	241	3.4	6.5	70.3	273	324	.....	8
61.6	17.1	6.6	0.7	0.07	79.6	0.8	0.6	0.10	.....	188	0	4.6	70.0	224	264	.....	9
47.1	12.0	5.2	1.0	45.0	0.9	0.3	159	1.4	4.3	34.6	167	196	6.3	0.4	10

near HIGH PRAIRIE, ALTA.

46.3	9.5	13.0	1.5	0.05	15.9	0.7	0.6	0.30	.....	189	2.2	5.9	0.0	155	189	15.6	0.6	11
25.9	5.7	6.0	1.1	0.10	12.6	1.8	1.0	.....	.....	101	0	8.4	4.9 (86.6)	87.9 (86.6)	113	12.7	.....	12

at ferry at WATINO, ALTA.

35.9	7.3	4.3	0.9	0.11	21.9	0.9	0.4	0.10	117	4.8	7.4	15.6	120	142	7.2	0.3	13
------	-----	-----	-----	------	------	-----	-----	------	-------	-----	-----	-----	------	-----	-----	-----	-----	----

at PEACE RIVER, ALTA.

47.8	12.1	6.8	0.8	0.04	44.4	1.2	0.0	0.10	166	2.4	4.3	29.0 (0.0)	169 (169)	201	8.0	0.5	14
47.1	10.6	6.0	0.5	0.10	25.3	4.8	0.2	0.05	.....	176	0	8.7	16.5	161	190	.....	15
40.6	9.9	7.3	0.5	.....	14.8	7.5	0.0	.....	.....	159	0	3.5	12.0	142	162	.....	16
39.1	7.5	3.0	7.8	.....	59.9	1.8	2.4	.....	.....	93.9	0	.....	51.4	128	168	.....	17
25.8	4.2	1.7	1.1	0.30	9.5	0.9	1.6	.....	.....	92.7	0	4.2	5.8	81.8	95.1	.....	18
																	19	
																	20	
29.6	6.6	3.0	0.6	0.09	13.6	2.9	0.2	0.05	104	2.4	4.8	11.6 (15.1)	101 (104)	115	21

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water tem- pera- ture (°F.)	pH	Colour	Turbidity	Suspended matter		Specific con- ductance $K \times 10^6$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)		Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre- foot	Tons per day

STATION No. 58—PEACE RIVER at

1	Sept./52—No sample taken.....		30,100†	.....								253	153	0.208	3,832	16.6
2	Oct. —No sample taken.....		33,300	.....								286	.....	.....	.....	.....
3	Nov. 20.....	7:20	9,300†	14,700	35	8.1	10	3	.....	.....	.....	321	.....	.....	.....	.....
4	Dec. 9.....	8:45	4,600	5,400	32	8.4	15	5	.....	.....	.....	380	231	0.314	5,090	30.0
5	Jan. 17/53.....	6:31	8,900	8,480	33	8.3	15	3	.....	.....	.....	278	.....	.....	.....	.....
6	Feb. 7.....	6:48	8,100	7,640	33	8.4	10	3	.....	.....	.....	.....	.....	.....	.....	.....
7	Average..... (9 samples)	9:26	32,178	22,997	40	8.1	10	210	.....	.....	.....	.....	.....	.....	.....	.....

† Discharge records at Taylor, B.C.

STATION NO. 56A—CLEARWATER

8	June 11/56.....	28:59	62	79	70	10	2.8	1.7	239	166	0.226	43.2
---	-----------------	-------	-------	----	----	----	----	-----	-----	-----	-----	-------	-------	------

STATION No. 57—NOTIKEWIN RIVER

9	Aug. 6/52.....	13:19	71	8.1 (8.4)	20	6 (7)	14	12	365	249	0.339	55.8
---	----------------	-------	-------	----	--------------	----	----------	----	----	-----	-----	-------	-------	------

STATION No. 58—HAY RIVER at

10	July 19/52.....	12:19	high	.....	66	7.6	120	4	.....	4.7	411	332	0.452	.....	82.4
11	Oct. 17/52.....	14:15	.....	.....	33	7.9	160	6	3.7	1.4	360	287	0.390	.....	76.4
12	Jan. 19/53.....	19:231	.....	.....	32	7.7	100	8	.....	.....	531	.....	.....	.....	.....
13	Apr. 29/53.....	9:131	.....	.....	33	7.5	80	2	.....	.....	413	.....	.....	.....	.....

STATION No. 59—SNARE RIVER (BIG

14	May 22/52*.....	14:15	.....	.....	40	7.1	10	2	.....	.....	35.8	37.6	0.051	.....	26.0
15	June 8, June 22†.....	110:135	725.3‡	.....	56	8.8	10	.....	.....	.....	62.8	.....	.....	.....	.....
16	July—No sample taken.														
17	Aug.—No sample taken.														
18	Sept. 18†.....	14:20	.....	.....	50	7.1	10	0.6	.....	.....	25.0	23.4	0.032	.....	13.2
19	Sept. 13, Sept. 26††	14:38	726.33	.....	48	7.9	10	.....	.....	.....	37.2	.....	.....	.....	.....

†† Composite samples; not included in average.

† Below Ghost River.

‡ Levels at dam.

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(*In parts per million*)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂)	Hardness as CaCO ₃	Sum of constituents	Per cent sodium	Saturation index	No.
		Sodium (Na)	Potassium (K)														

PEACE RIVER, ALTA.—*Concluded*

																	1
																	2
34.9	7.8	4.3	0.8	0.27	19.5	3.2	0.3	0.05	.....	132	0	4.6	11.0	119	141	.....	3
40.6	9.8	3.5	0.7	.....	23.7	1.4	0.5	.....	.....	152	2.4	6.7	13.2	142	164	.....	4
45.8	11.3	3.8	0.4	.....	33.6	1.9	0.5	.....	.....	161	3.6	6.0	23.0	161	186	.....	5
52.5	14.3	6.5	1.1	0.12	30.6	5.0	0.7	0.05	.....	204	2.6	10	18.3	190	224	.....	6
30.6	9.1	4.3	1.5	.....	25.6	3.3	0.4	.....	.....	142	1.2	6.1	18.1	136	181	6.3 0.4	7

RIVER at FORT MACMURRAY, ALTA.

19.3	5.6	22.0	1.7	0.15	8.2	27.0	4.0	0.00	91.4	0	6.7	0.0	70.8	141	38.8	0.4	8
------	-----	------	-----	------	-----	------	-----	------	-------	------	---	-----	-----	------	-----	------	-------	-----	---

at bridge at MANNING, ALTA.

47.0	10.7	13.5	1.9	0.04	60.3	1.1	0.4	0.20	148	2.9	3.6	34.8	161 (167)	215	15.2	0.4	9
------	------	------	-----	------	------	-----	-----	------	-------	-----	-----	-----	------	--------------	-----	------	-----	-------	---

HAY RIVER SETTLEMENT, N.W.T.

52.2	13.9	12.7	2.0	0.19	109	4.8	0.7	.....	.....	113	0	5.2	95.3	188	256	12.7	.....	0.2	10
46.0	12.0	11.5	1.4	0.32	83.3	6.0	0.6	.....	0.00	113	0	5.0	72.0	164	222	13.1	.....	0	11
64.9	16.7	22.5	3.0	0.08	13.0	8.2	1.0	.....	.....	163	0	.....	96.8	231	326	17.3	0.1	.....	12
48.1	13.6	15.9	2.9	0.35	96	4.2	1.0	.....	.....	130	0	.....	69.4	176	250	16.1	.....	0.3	13

SPRUCE LAKE) at power plant near RAE, N.W.T.

4.3	0.4	1.0	0.9	0.1	4.0	1.0	0.3	0.02	.....	12.2	0	0.8	2.2	12.2	19.0	.....	.....	14
6.9	2.1	2.1	0.8	.....	8.2	1.0	0.5	.....	.....	24.9	4.8	33	0.0	25.9	38.7	.....	.....	15
																	16	
																	17	
3.8	0.3	1.5	0.5	0.02	5.1	1.0	0.2	0.07	0.00	10.5	0	1.5	2.2	10.8	19.2	.....	.....	18
4.0	1.2	1.6	0.6	.....	4.9	1.4	0.3	.....	.....	18.1	0	12	0.3	15.1	22.9	.....	.....	19

TABLE II—Continued

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^6$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)		Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day

STATION No. 59—SNARE RIVER (BIG)

1	Oct. 13.....	85:108	726.85	no	38	9.1	.....	.....	.....	.....	58.5	.....	.....	.....
2	Oct. 29*.....	69:92	726.8	discharge	36	9.0	.....	.....	.....	.....	53.0	.....	.....	.....
3	Nov. 12.....	55:78	726.70	records	34	8.8	.....	.....	.....	.....	50.0	.....	.....	.....
4	Nov. 28*.....	41:84	726.8		32	9.3	.....	.....	.....	.....	60.6	.....	.....	.....
5	Dec. 24.....	114:150	726.8		32	8.8	15	medium	.....	.....	53.1	.....	.....	.....
6	Jan., 1953—No sample taken.													
7	Feb. 16/53.....	60:96	726.3		32	9.2	10	medium	.....	.....	59.4	.....	.....	.....
8	Mar. 4.....	13:49	726.0		32	7.7	10	slight	.....	.....	40.7	.....	.....	.....
9	Mar. 26.....	22:58	725.0		32	7.6	15	slight	.....	.....	41.2	.....	.....	.....
10	May 10*.....	107:159	724.15		35	7.5	10	4	.....	.....	47.0	.....	.....	.....
11	May 22.....	103:147	724.15		38	7.0	5	1	.....	.....	46.2	.....	.....	.....
12	June—No sample taken.													
13	July 16.....	48:92	726.0		61	9.0	5	1	.....	.....	52.6	.....	.....	.....
14	Aug. 4.....	29:72	725.7		65	9.0	5	2	.....	.....	53.7	.....	.....	.....
15	Average..... (10 samples)	54:87	.....		41	8.3	.....	.....	.....	.....	48.0	.....	.....	.....

* Not included in average.

STATION No. 60—EMILE

16	Sept. 14/52.....	18:24	50	7.3	5	0.7	40.7	29.6	0.040	11.4
----	------------------	-------	-------	-------	----	-----	---	-----	-------	-------	------	------	-------	-------	------

STATION No. 61—LIARD RIVER at WATSON LAKE,

17	June 24/52.....	28:30	142,000 ^e	114,000	50	7.7	20	8	30	27	123	81.8	0.111	31,240	11.8
18	July 23.....	22:23	89,500	108,000	58	7.8	20	2	.....	.....	157	.....	.....	.....	.....
19	Aug. 21.....	21:27	41,400	46,800	52	7.9	5	0.9	.....	.....	176	115	0.156	12,793	11.2
20	Sept. 23.....	17:27	54,200	54,000	46	7.8	10	0.9	.....	.....	243	.....	.....	.....	.....
21	Oct. 23.....	21:33	46,500	48,800	33	8.0	15	0.9	.....	.....	246	147	0.200	18,368	17.8
22	Nov. 22.....	215:216	20,300	23,900	33	7.8	10	.....	.....	.....	337	.....	.....	.....	.....
23	Dec. 23.....	184:185	11,200	13,100	32	7.4	10	.....	.....	.....	263	.....	.....	.....	.....

^e Estimated. Ice conditions Oct. 21/51 to May 9/52; Nov. 26/52 to May 13/53.

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(*In parts per million*)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂) Colorimetric	Hardness as CaCO ₃		Sum of constituents	Per cent sodium	Saturation index	No.
		Sodium (Na)	Potassium (K)										Non-carbonate	Total				

SPRUCE LAKE) at power plant near RAE, N.W.T.

7.5	1.4	2.5	0.8	.....	2.5	0.2	.....	.....	.....	12.2	9.6	.....	0.0	24.4	30.5	.....	.....	1
6.6	1.5	2.0	0.6	.....	2.5	0.2	.....	.....	.....	18.1	6.7	.....	0.0	22.8	28.0	.....	.....	2
6.5	1.3	2.0	0.8	.....	3.3	0.6	.....	.....	.....	16.1	5.5	.....	0.0	21.5	27.9	.....	.....	3
6.3	2.1	3.5	0.6	.....	2.5	0.8	.....	.....	.....	17.5	8.0	.....	0.0	24.4	32.4	.....	.....	4
5.5	2.1	9.0	3.5	.....	5.3	0.3	.....	.....	.....	48.8	1.2	.....	0.0	22.2	50.9	.....	.....	5
																		6
6.1	2.2	10.8	2.4	.....	4.1	0.3	.....	.....	.....	46.1	5.5	.....	0.0	24.2	54.1	.....	.....	7
4.7	1.9	3.0	2.4	.....	3.3	0.1	.....	.....	.....	29.3	0	.....	0.0	19.4	29.8	.....	.....	8
4.7	2.2	2.0	1.0	.....	3.3	0.6	.....	.....	.....	25.6	0	.....	0.0	20.6	26.4	.....	.....	9
5.9	1.6	3.5	1.8	.....	.....	1.0	1.6	.....	.....	22.2	0	.....	0.0	21.2	.....	.....	.....	10
4.0	2.5	3.0	1.7	.....	.....	0.8	1.2	.....	.....	24.4	0	.....	0.3	20.3	.....	.....	.....	11
																		12
7.9	0.9	4.5	1.6	0.05	.....	0.8	1.2	.....	.....	18.1	6.2	.....	0.0	23.2	.....	.....	.....	13
6.1	1.3	4.0	1.8	.....	.....	0.8	1.2	.....	.....	17.3	6.2	.....	0.0	20.7	.....	.....	.....	14
5.7	1.6	4.2	1.7	.....	3.8	0.6	.....	.....	.....	24.8	3.4	.....	0	20.8	33	30.3	.....	0.9 15

RIVER near RAE, N.W.T.

4.8	1.1	1.2	0.8	0.02	4.7	1.0	0.1	0.05	0.00	17.3	0	1.6	2.2	16.4	23.9	12.9	2.2	16
-----	-----	-----	-----	------	-----	-----	-----	------	------	------	---	-----	-----	------	------	------	-------	-----	----

Y.T.—Drainage area at Lower Crossing, 38,800 square miles

18.9	4.1	1.0	0.4	0.05	8.8	0.5	0.3	0.30	.....	66.1	0	6.2	9.7	63.9	73.6	.....	.....	17
22.1	4.7	1.0	0.3	.....	8.8	0.1	0.0	0.20	.....	83.0	0	5.4	6.5	74.5	83.5	.....	.....	18
26.3	5.6	1.0	0.4	0.06	9.5	0.7	trace	0.10	.....	98.6	0	14	8.1	88.9	106	.....	.....	19
34.8	8.4	1.9	0.4	.....	10.3	1.7	0.2	.....	.....	143	0	9.8	4.4	121	138	.....	.....	20
34.5	9.3	2.0	0.8	0.07	8.4	0.9	0.3	0.10	.....	147	0	8.2	3.9	124	137	.....	.....	21
45.1	14.4	2.0	0.6	.....	22.2	0.1	0.4	.....	.....	199	0	20	8.6	172	203	.....	.....	22
35.1	9.1	1.6	0.8	.....	20.2	0.1	0.6	.....	.....	132	0	9.4	18.0	126	142	.....	.....	13

TABLE II—Continued
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(*In parts per million*)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^6$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)			Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day	

STATION No. 61—LIARD RIVER at WATSON LAKE,

1	Jan. 23/53.....	159:173	9,700	10,200	33	8·1	10	3	.....	.....	253	92·4	0·126	2,415	29·8
2	Feb. 23.....	122:123	7,800	7,790	33	8·0	5	.....	.....	.....	290	.....	.....	.....	.....
3	Mar. 26.....	91:92	6,850	6,970	33	7·6	10	.....	.....	.....	328	.....	.....	.....	.....
4	Apr. 28.....	59:78	13,200	8,780	34	7·8	20	3	4·2	1·4	239	148	0·201	5,254	61·4
5	May 23.....	32:53	107,000	65,000	47	7·8	40	4	9·4	6·4	187	116	0·158	33,384	47·2
6	Average..... (12 samples)	81:88	45,765	42,280	40	7·8	15	3	.....	.....	237	.....	.....	.....	.....

STATION No. 62—LIARD RIVER

7	Aug. 26/52.....	64:67	.....	.....	54	8·0	30	430	425	393	265	167	0·227	.....	20·4
8	Sept. 22.....	37:53	.....	.....	48	8·1	20	15	.....	.....	253	.....	.....	.....	.....
9	Oct. 21.....	108:142	.....	.....	33	8·2	.....	.....	.....	.....	270	208	0·283	.....	62·0
10	Nov. 27.....	71:120	.....	No	32	8·2	0	heavy	.....	.....	353	.....	.....	.....	.....
11	Dec. 26.....	42:91	.....	discharge	32	7·8	0	slight	.....	.....	406	.....	.....	.....	.....
12	Jan. 23/53.....	223:276	.....	records	32	7·8	5	2	.....	.....	404	.....	.....	.....	.....
13	Feb.—No sample taken.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
14	Mar. 10.....	167:220	.....	.....	32	8·0	10	15	.....	.....	416	.....	.....	.....	.....
15	Mar. 20.....	167:223	.....	.....	32	7·6	5	2	.....	.....	433	.....	.....	.....	.....
16	Apr. 27.....	129:185	.....	.....	32	7·1	10	7	.....	.....	223	.....	.....	.....	.....
17	May 23.....	104:159	low	.....	58	7·9	.....	65	.....	.....	194	.....	.....	.....	.....
18	June 23.....	73:115	low	.....	58	8·1	.....	heavy	250	225	216	174	0·237	.....	44·0
19	July 24.....	109:181	.....	.....	60	8·2	30	80	194	184	225	144	0·196	.....	38·2
20	Aug. 22*.....	80:137	low	.....	62	8·2	20	50	.....	.....	268	.....	.....	.....	.....
21	Average..... (12 samples)	108:153	.....	.....	42	7·9	12	80	.....	.....	305	.....	.....	.....	.....

* Not included in average.

STATION No. 63—GREAT BEAR

22	1948.....	.....	.....	.....	7·5	.....	.....	.....	.....	.....	96·0	0·131	.....	.....	.....
23	Aug. 24/52.....	6:23	normal†	No record	41	7·6	3	0·5	.....	.....	154	96·0	0·131	.....	24·0
24	Nov. 24/52—Sample lost in transit.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
25	Mar. 24/53.....	129:153	normal†	No record	32	8·9	10	6	.....	.....	20·0	0·027	.....	.....	6·4
26	June 25/53.....	36:60	normal†	387·93††	35	7·7	100	5	1·1	0	177	104	0·141	.....	26·8

† Collector's estimate of river flow.

†† Water elevation.

TABLE II—Continued

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Continued
(In parts per million)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe)	Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂)	Sum of constituents		Per cent sodium	Saturation index	No.
		Sodium (Na)	Potassium (K)											Colorimetric	Non-carbonate	Total		

Y.T.—Drainage area at Lower Crossing, 38,800 square miles

41.2	4.8	6.0	2.0	0.15	6.8	1.3	0.6	.....	.....	154	0	.....	0.0	123	139	.....	.....	1
39.9	9.8	2.7	0.8	.....	13.6	0.1	0.8	.....	.....	163	0	12	6.4	140	160	.....	.....	2
45.9	12.0	1.7	0.6	.....	10.1	0.2	0.8	.....	.....	193	0	30	5.8	164	197	.....	.....	3
33.4	9.4	2.8	1.2	0.02	7.5	0.2	0.8	0.00	0.00	149	0	7.2	0.0	122	138	.....	.....	4
26.6	6.2	2.5	1.4	0.08	8.3	1.2	0.6	0.10	.....	111	0	7.4	1.4	62.0	109	.....	.....	5
33.7	8.2	2.2	0.8	.....	11.2	0.6	0.5	.....	.....	137	0	12	5.7	118	137	3.9	0.0	6

at FORT SIMPSON, N.W.T.

37.1	10.0	2.4	1.4	0.05	31.3	1.2	0.5	.....	0.05	122	3.6	5.5	27.4	134	153	.....	.....	7
35.8	9.2	2.3	0.7	.....	30.5	0.7	0.4	.....	.....	127	0	5.3	23.4	127	147	.....	.....	8
38.1	10.7	4.0	0.6	0.79 (total)	33.1	1.4	0.6	.....	.....	134	0	10	29.6	139	164	.....	.....	9
49.3	14.1	3.8	1.0	.....	39.3	2.2	0.6	.....	.....	182	0	21	32.4	181	224	.....	.....	10
56.6	15.8	7.2	1.1	.....	44.0	2.3	6.0	.....	.....	212	0	11	32.8	206	248	.....	.....	11
57.6	13.6	10.0	2.0	.....	40.1	9.9	0.8	.....	.....	200	0	24	36.0	200	257	.....	.....	12
																		13
52.8	14.0	16.6	2.3	0.68 (total)	40.7	10.8	2.4	.....	.....	206	0	.....	20.9	190	300	.....	.....	14
57.4	15.5	11.5	2.0	.....	37.7	13.7	0.8	.....	.....	209	0	23	35.8	207	265	.....	.....	15
29.7	7.7	4.5	1.8	.....	21.4	3.4	1.2	.....	.....	105	0	10	19.3	106	132	.....	.....	16
29.9	5.3	2.5	1.0	.....	18.9	0.6	1.2	.....	.....	97.8	0	7.3	16.1	96.3	115	.....	.....	17
32.6	6.6	3.0	1.5	1.09	27.1	0.7	0.7	.....	.....	105	0	7.5	26.5	109	131	.....	.....	18
30.1	7.8	2.7	1.6	0.22	23.7	0.5	0.4	.....	.....	109	0	6.9	18.4	107	127	.....	.....	19
37.0	10.3	2.9	1.2	.....	27.9	1.0	0.2	.....	.....	123	5.6	7.4	24.5	135	154	.....	.....	20
42.3	10.9	5.9	1.4	.....	32.3	4.0	1.3	.....	.....	151	0.3	12	26.5	150	185	7.8	0.2	21

LAKE near PORT RADIUM, N.W.T.

17.5	8.5	7.1 as Na.		0.12	14.0	5.5	0.7	.....	.....	71.7	0	4.0 (grav.)	19.8	78.6	92.7	.....	0.9	22
16.7	6.5	4.0	0.7	0.02	14.3	5.9	0.5	0.20	.....	65.9	0	4.5	14.5	68.5	85.7	11.1	0.9	23
																		24
2.9	1.4	3.8	1.6	0.04	4.9	1.2	0.0	.....	.....	15.6	2.9	16	0.0	12.9	42.7	35.6	0.8	25
15.4	6.6	6.2	2.0	0.05	16.3	5.1	0.2	0.00	.....	72.0	0	13	6.6	65.6	100	18.5	0.8	26

TABLE II—Concluded

Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Concluded
(In parts per million)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^4$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)		Loss on ignition at 550°C.
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot	Tons per day

STATION No. 64—GREAT BEAR RIVER

1	July 31/52.....	7:13	low†	.....	46	7.9	0	6	.....	.....	154	94.4	0.128	.....	33.6
2	Aug. 30.....	23:30	medium	.....	38	7.6	15	3	.....	.....	157	.....	.....	.....	.....
3	Sept. 27.....	13:23	"	No	40	7.8	30	4	.....	.....	158	.....	.....	.....	.....
4	Oct.—Lost in transit.			discharge											
5	Nov.—No sample taken.			records											
6	Dec. 27.....	27:52	low	.....	34	8.0	10	slight	.....	.....	170	.....	.....	.....	.....
7	Jan., 1953														
8	Feb.	No samples taken;													
9	Mar.	ice conditions.													
10	April														
11	May														
12	June 7/53.....	9:25	high	.....	45	7.4	30	105	98	88	225	156	0.212	.....	53.8
13	June 29.....	14:43	"	.....	47	7.9	10	3	.....	.....	161	.....	.....	.....	.....

† Collector's estimate of river flow or level.

STATION NO. 64A—BOSWORTH

14	Mar./56.....					8.5	5	.....	.....	.....	554	368	0.500	.....	66.4
15	Oct. 11/56.....					8.1	20	.....	.....	.....	619	.....	.....	.....	.....

STATION No. 65—ARCTIC RED RIVER

16	Sept. 3/52.....	29:35	.....	.....	46	7.6	60	55	84	76	310	209	0.284	.....	30.8
17	Dec. 1/52.....	211:220	.....	.....	32	7.8	40	10	5.4	2.6	977	643	0.874	.....	133
18	Mar. 1/53.....	121:136	low†	.....	34	7.4	10	8	.....	.....	357	.....	.....	.....	.....
19	June 3/53.....	27:89	high (spring flood)	.....	54	7.6	.....	190	.....	.....	185	.....	.....	.....	.....

STATION No. 66.—PEEL RIVER

20	Sept. 3/52.....	16:17	medium†	.....	47	7.8	35	35	67	62	307	216	0.294	.....	41.6
21	Dec. 3/52.....	264:317	low	.....	33	7.8	10	2	.....	.....	403	.....	.....	.....	.....
22	Mar. 4/53.....	173:239	low	.....	33	7.7	10	2	.....	.....	423	.....	.....	.....	.....
23	June 1/53.....	95:137	high	.....	46	7.8	.....	very high	495	456	199	149	0.203	.....	33.4

† Collector's estimate of river flow or level.

TABLE II—Concluded
Chemical Analyses of Surface Waters in the Mackenzie River Drainage Basin—Concluded
(*In parts per million*)

Calcium (Ca)	Magnesium (Mg)	Alkalies		Iron (Fe)	Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂)	Hardness as CaCO ₃	Sum of constituents	Per cent sodium				No.
		Sodium (Na)	Potassium (K)														+ —	Saturation index		

near mouth, at FORT NORMAN, N.W.T.

15.3	6.8	4.2	0.3	0.11	14.7	5.8	0.4	0.05	.....	63.4	0	4.2	14.1	66.1	83.1	12.1	.....	0.6	1
16.5	6.5	4.3	0.5	.....	14.2	5.5	0.8	.....	.....	68.3	0	3.7	11.8	67.8	85.6	12.0	.....	1.0	2
18.1	6.1	4.1	0.8	.....	16.5	5.8	0.8	.....	.....	67.8	0	3.8	14.8	70.4	89.4	11.1	.....	0.7	3
																			4
																			5
17.0	7.6	5.4	0.8	.....	17.2	6.2	.....	.....	.....	73.2	0	7.8	13.6	73.6	88.0	13.6	.....	0.4	6
																			7
																			8
																			9
																			10
																			11
29.4	6.3	5.2	1.0	0.09	23.8	7.4	30	0.00	0.00	88.6	0	3.8	26.6	99.2	125	10.1	.....	0.7	12
15.8	6.6	5.5	1.0	.....	16.0	5.8	0.6	.....	.....	70.3	0	4.4	8.9	66.5	90.3	15.0	.....	0.6	13

CREEK at NORMAN WELLS, N.W.T.

68.8	26.2	12.6	1.0	0.02	110	12.6	0.4	0.10	.....	195	6.5	4.8	108	279	340	8.8	1.1	.....	14
75.3	26.9	16.5	1.0	0.04	130	16.3	0.8	0.20	.....	216	0	3.8	121	299	379	10.6	0.8	.....	15

near ARCTIC RED RIVER SETTLEMENT

39.0	13.2	3.7	0.8	0.53	69.8	1.0	0.6	.....	0.05	108	0	3.1	63.0	152	185	5.0	.....	0.3	16
144	28.1	38.5	4.2	0.32	132	19.4	1.2	.....	.....	431	0	18	123	476	597	14.8	1.1	.....	17
44.5	7.2	14.5	1.7	.....	50.6	18.3	0.6	.....	.....	114	0	14	47.0	141	207	18.1	.....	0.4	18
22.8	7.0	3.4	1.4	.....	34.0	1.4	0.4	.....	.....	70.3	0	2.3	27.9	85.5	107	7.8	.....	0.7	19

at FORT McPHERSON, N.W.T.

42.3	12.4	2.8	0.4	0.09	50.3	2.5	0.7	.....	.....	127	0	3.3	52.4	156	177	3.7	.....	0	20
54.5	16.2	6.8	2.0	.....	58.6	3.4	3.2	.....	.....	181	0	30	54.3	203	264	6.7	0.2	.....	21
56.3	15.8	8.6	1.6	.....	53.1	4.6	1.0	.....	.....	201	0	15	40.8	206	255	8.3	0.2	.....	22
26.7	6.6	3.4	1.5	0.79	35.6	1.4	0.6	.....	.....	77.1	0	4.4	30.7	93.9	118	7.1	0.3	.....	23

TABLE III
Chemical Analyses of Surface Waters in the Yukon River Drainage Basin in Canada
(*In parts per million*)

No.	Date of collection	Storage period (Days)	Stream discharge (Second-feet)		Water temperature (°F.)	pH	Colour	Turbidity	Suspended matter		Specific conductance $K \times 10^4$ at 25°C.	Residue on evaporation dried at 105°C. (Dissolved solids)		Loss on ignition at 550°C.	
			On sampling date	Monthly mean					Dried at 105°C.	Ignited at 550°C.		P.P.M.	Tons per acre-foot		

STATION No. 1Y—MAYO RIVER at

1	Mar. 23/53.....	23:28	7.5	15	slight	194	109	0.148	12.4
---	-----------------	-------	-------	-------	-------	-----	----	--------	-------	-------	-----	-----	-------	-------	------

STATION No. 2Y—STEWART RIVER at

2	July 3/52.....	5:14	37,200	26,500	53	8.0	30	50	106	81	175	119	0.162	11,904	20.4
3	Oct. 15/52.....	23:41	13,800	16,100	35	8.0	20	20	20	16	260	165	0.224	6,127	20.4
4	Feb. 7/53.....	151:185	1,340	1,360	32	8.1	5	7	8.3	6.8	378	101	0.137	364.5	9.0
5	June 5/53.....	33:67	31,300	29,700	55	9.3	20	50	54	49	221	71.0	0.097	5,978	9.6

Ice conditions October 27, 1951 to April 3, 1952; November 15, 1952 to May 11, 1953.

STATION No. 3Y—YUKON (LEWES) RIVER at

6	Aug. 20/52.....	17:28	17,100	16,900	46	7.5	0	2	.....	.....	87.2	55.4	0.075	2,548	6.6
7	Sept. 29.....	18:29	15,900	16,800	31	7.6	5	0.6	.....	.....	90.1	.....	.....	.....	.....
8	Oct. 21.....	17:35	14,800	15,600	36	7.8	5	0.7	.....	.....	90.0	54.4	0.074	2,161	7.6
9	Nov. 24.....	12:78	9,060	11,000	31	8.0	5	3	.....	.....	96.3	.....	.....	.....	.....

Ice conditions October 31, 1951, to May 28, 1952; December 3, 1952 to May 22, 1953.

STATION No. 4Y—YUKON RIVER at DAWSON,

10	June 25/52.....	33:35	155,000	164,000	59	7.8	20	95	161	156	175	121	0.165	50,375	24.0
11	July 24.....	19:22	156,000	163,000	61	7.9	.....	560	.....	.....	189	.....	.....	.....	.....
12	Aug. 6—No sample taken.....	.....	112,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
13	Sept. 8.....	21:26	104,000	109,000	49	7.9	20	30	.....	.....	195	.....	.....	.....	.....

Ice conditions, October 7, 1951, to May 22, 1952.

STATION No. 5Y—MCINTYRE

14	Jan. 1955.....	.....	.....	.....	.....	7.8	.....	2	7.2	.....	.....	212	0.288	.....	.....
15	May 25/55.....	.....	.....	36	8.6	10	6	.....	.....	.....	360	.....	.....	.....	.....
16	Oct. 12/55.....	13:19	.....	.....	8.3	10	.....	.....	.....	.....	272	.....	.....	.....	.....
17	Nov. 30/55.....	19:29	.....	40	8.3	5	.....	.....	.....	.....	261	.....	.....	.....	.....
18	Jan. 3/56.....	20:28	.....	.....	8.7	5	.....	.....	.....	.....	274	.....	.....	.....	.....
19	Feb. 7/56.....	20:27	.....	.....	8.3	5	.....	.....	.....	.....	264	.....	.....	.....	.....
20	Aug. 26/56.....	65:87	.....	50	8.3	20	3	.....	.....	.....	272	179	0.243	.....	32.4

TABLE III
Chemical Analyses of Surface Waters in the Yukon River Drainage Basin in Canada
(In parts per million)

Calcium (Ca)	Magnesium (Mg)	Alkalies			Iron (Fe) Dissolved	Sulphate (SO ₄)	Chloride (Cl)	Nitrate (NO ₃)	Fluoride (F)	Boron (B)	Bicarbonate (HCO ₃)	Carbonate (CO ₃)	Silica (SiO ₂) Colorimetric	Hardness as CaCO ₃	Non-carbonate	Total	Sum of constituents	Per cent sodium	Saturation index		No.
		Sodium (Na)	Potassium (K)	Dissolved														+ | -			
power plant near MAYO, Y.T.																					

power plant near MAYO, Y.T.

28.8	5.5	6.4	2.4	0.11	22.6	1.2	0.5	90.8	0	20.8	94.4	112	12.5	0.6	1
------	-----	-----	-----	------	------	-----	-----	-------	-------	------	---	-------	------	------	-----	------	-------	-----	---

MAYO, Y.T.—Drainage area, 12,600 square miles

23.1	5.8	1.3	0.4	0.13	26.1	1.2	0.2	0.10	0.02	69.8	0	4.4	24.4	81.6	96.1	3.3	.....	0.2	2
33.0	11.4	3.4	0.9	0.09	43.6	1.2	0.4	.....	.....	107	0	4.4	41.3	129	151	5.4	0.2	.....	3
55.4	11.5	8.5	.....	.....	45.4	1.3	0.6	0.00	.....	183	0	16	35.7	186	229	.....	0.5	.....	4
26.9	7.7	8.8	2.4	0.02	27.8	1.2	0.4	0.02	.....	81.0	12.0	19	12.6	99.0	146	15.8	1.2	.....	5

WHITEHORSE, Y.T.—Drainage area, 7,500 square miles

13.4	1.8	1.3	0.7	0.05	5.8	0.9	0.0	0.15	.....	46.4	0	3.8	3.0	41.0	50.7	6.3	.....	1.5	6
13.7	2.0	1.3	0.8	.....	6.0	1.4	trace	.....	.....	47.1	0	6.5	3.9	42.5	53.9	6.1	.....	1.1	7
13.6	2.2	1.3	0.9	0.08	5.9	0.4	trace	0.10	.....	47.8	0	3.5	3.9	43.1	51.5	6.0	.....	0.9	8
13.3	2.2	1.5	0.8	.....	7.2	0.4	0.2	.....	.....	45.9	0	3.2	4.7	42.3	51.4	7.0	.....	0.8	9

Y.T.—Drainage area, 106,000 square miles

24.1	6.0	2.1	1.1	0.13	20.8	0.6	0.4	0.10	.....	81.3	0	6.4	18.2	84.8	102	5.0	.....	0.4	10
25.6	6.8	2.3	1.9	.....	23.0	0.2	0.1	0.20	.....	89.1	0	6.4	19.0	92.0	110	5.0	.....	0.2	11
26.8	6.5	2.1	1.3	.....	27.2	0.5	trace	.....	.....	87.1	0	7.0	22.3	93.7	114	4.6	.....	0.3	13

CREEK near WHITEHORSE, Y.T.

48.8	13.1	.....	.....	.....	7.5	4	.....	.....	.....	186	1	14	0	176	.....	.....	.....	.....	14
49.5	13.3	3.0	1.5	.....	4.9	0.3	0.8	.....	.....	210	6.6	13	0	178	196	.....	1.2	.....	15
38.9	9.3	3.2	1.0	.....	9.3	0.3	1.6	.....	.....	186	0	16	0	135	162	4.8	0.5	.....	16
37.4	9.8	3.9	1.1	.....	7.3	0.4	2.4	.....	.....	162	0	16	0	133	158	5.9	0.6	.....	17
38.8	11.5	4.5	1.1	.....	6.5	0.5	0.8	.....	.....	151	12.0	.....	0.6	144	211	6.3	1.0	.....	18
37.8	9.6	3.5	1.1	.....	8.0	0.3	.....	.....	.....	156	0	22	5.8	134	.....	5.3	0.5	.....	19
41.0	9.3	3.7	1.0	0.00	7.4	0.4	1.2	0.00	.....	175	0	13	0	141	163	5.3	0.7	.....	20

DESCRIPTION OF MUNICIPAL WATER SYSTEMS

(A. Mackenzie River Drainage Basin)

Municipality.....	AKLAVIK, N.W.T.		ATHABASCA, ALTA.	
Population served:		1953		1951
In municipality.....		.....		1,200 (1,068 ^e)
Outside municipality.....		.....		.....
Total.....		500-700†		1,200
Date(s) of survey.....	Dec. 1954††		October 2, 1951.....	
Ownership.....	Owned by Dept. of Northern Affairs and National Resources; operated by local committee.*		Municipally owned and operated.....	
Source of supply.....	Amuskeg pond; site of Aklavik is being moved in 1954-56 and new source of water (Mackenzie River) and system will then be installed.		Athabasca River.....	
Treatment.....	Alum added prior to filtration through diatomaceous earth; chlorinated (sodium hypochlorite).		Chlorination (sodium hypochlorite) as river water pumped to reservoir on hill; water then enters system by gravity.	
Storage capacity (thousand gallons).....	Pressure tank.....	2	One covered reservoir.....	1,250
Consumption (average in m.g.d.).....	No information (pumping capacity 40 g.p.m.).....			
Industrial use.....	No industrial use.....			
Remarks.....	System installed in 1951. † Wide fluctuations. †† Data from Dept. of Northern Affairs and National Resources. * A summer system only; pipes etc. removed during winter.		No industrial use; a lumbering and farming centre. System installed in 1949.	
• Population according to Ninth Census of Canada, 1951.				
Municipality.....	EDSON, ALTA.		FAIRVIEW, ALTA.	
Population served:	1951	1953	1951	
In municipality.....	2,000 (1956 ^e)	2,345	924 (929 ^e)	
Outside municipality.....	0	0	270	
Total.....	2,000	2,345	1,194	
Date(s) of survey.....	September 25, 1951; 1953†.....		Sept. 1951; Aug. 6, 1952†.....	
Ownership.....	Municipally owned and operated.....		Municipally owned and operated.....	
Source of supply.....	Three wells, 108, 120 and 145 feet deep.		Water from several lakes which are fed by spring run-off.	
Treatment.....	No treatment; well water pumped to ground reservoir and then to elevated tank and system.		No treatment in 1951; in 1952 water flows by gravity to system from dam reservoir with chlorine dioxide treatment.* Dam reservoir is fed by ditches from small lakes.	
Storage capacity (thousand gallons).....	Concrete ground reservoir.....	100	One dam reservoir.....	30,000
Consumption (average in m.g.d.).....	Elevated tank.....	60		
Industrial use.....	1951	1953	1951	1952
Remarks.....	0.07 (approx.)	0.08		
• Population according to Ninth Census of Canada, 1951.	A C.N.R. divisional point. The district is a farming and lumbering community with coal mining nearby. System installed during 1950-51.		Not known An agricultural school; a farming community with six grain elevators.	
	† Data from Dept. of Economic Affairs of Alberta.		Original system installed in 1950; a treatment plant was under consideration in 1952. * CuSO ₄ and activated carbon added periodically to reservoir. † Dept. of Economic Affairs of Alta.	

DESCRIPTION OF MUNICIPAL WATER SYSTEMS
(A. Mackenzie River Drainage Basin)—Continued

BARRHEAD, ALTA.		BEAVERLODGE, ALTA.		DAWSON CREEK, B.C.	
1951	1952	1951	1955	1951	1952
1,243° 0	.....	509 (514°) 0	400 0	3,589° 1,000	4,000 1,000
<u>1,243</u>	<u>1,300</u>	<u>509</u>	<u>400</u>	<u>4,589</u>	<u>5,000</u>
July 30, 1952.....		September, 1951†, 1954; February 18, 1955.....		October 5, 1951; August 1952.....	
Municipally owned and operated.....		Municipally owned and operated.....		Municipally owned and operated.....	
Two wells, 120 feet deep.....		Two wells—210 and 250 ft. deep; in 1955 well 210 feet deep.		Kiskatinaw River, 14 miles distant.....	
In 1952, no treatment; pumped from one well direct to system; from other well to tank and then to system. In 1953, three deep wells with occasional chlorination.		No treatment; pumped to reservoir and system..		River water pumped to two earthen reservoirs (settling basins), alum and lime treated, pressure-filtered (sand), chlorinated and pumped to system and concrete ground reservoir on nearby hill.	
Elevated tank.....40	No data.....	Reservoir.....50	1954	3 ground reservoirs.....3,000 total	1951
			1955		1952
			0·010		0·2
			0·010		0·25 (max. 0·3 min. 0·18)
A farming community.		Plant capacity—21,600 g.p.d.		No major industrial user. A farming and lumbering community.	
Original system installed in 1948.		No major industrial user. Main industry is seed growing; six grain elevators.		River very turbid at times; alum used only during spring breakup and after heavy rains.	
† Data from the Dept. of Economic Affairs of Alberta. System installed in 1951.					
FORT NELSON, B.C.†		FORT SMITH, N.W.T.		GRANDE PRAIRIE, ALTA.	
1951	1953	1951	1953	1951	1953
.....	.....	.....	.....	.....	..... (2,664°)
.....
.....	400*	.....	.....	3,000	.....
December, 1955.....		1951: system installed in 1950.		October 4, 1951.....	
Owned and operated by Dept. Nat. Def.....		Owned and operated by federal government.		Municipally owned and operated.....	
Previously Muskwa River and treated water from RCAF base; In late 1955, wells.		Slave River.†.....		Bear Creek.....	
Well water, lime-softened in central plant, chlorinated and pumped to system.		Water coagulated (alum), rapid-sand filtered, treated with soda ash, chlorinated (sodium hypochlorite) and pumped to system which is buried 13 ft. deep.		From impounding reservoir water is pumped, with alum treatment, to coagulating and settling basins, then aerated, rapid-sand filtered, chlorinated and pumped to elevated tank and system.	
Elevated tank.....no data		Underground concrete tank.....40		Impounding reservoir.....210,000	
Underground reservoir.....“ “		1953		Elevated tank.....60	
No data.....		0·025 (Max. 0·30)		1951	
Army camp heating system and other camp uses.		No major industrial user.		0·080 (Max. 0·095 Min. 0·065)	
† System supplying D.N.D. camp, Muskwa Garrison, Fort Nelson, B.C.		† Contaminated usually with varying mixture of ground water, see pages 64-65.		No major industrial user; a farming and lumbering centre.	
R.C.A.F. base also has a supply system.		* Only 50 connections; others use street taps, etc.		System installed prior to 1940 and extended in 1949-50.	

DESCRIPTION OF MUNICIPAL WATER SYSTEMS

(A. Mackenzie River Drainage Basin)—Continued

Municipality.....	GRIMSHAW, ALTA.	HIGH PRAIRIE, ALTA.		
Population served:	1951	1951	1952	1954
In municipality.....	568 (564 ^c)	1,141 ^c	.....	.....
Outside municipality.....	0	0	.....	.....
Total.....	568	1,141	1,140	1,402
Date(s) of survey.....	September 1951†; August 6, 1952.....	February 6, 1952; May 1955†.....		
Ownership.....	Municipally owned and operated.....	Municipally owned and operated.....		
Source of supply.....	Spring, 2½ miles distant.....	One well; in 1955 two wells, 560 and 571 ft. deep.		
Treatment.....	No treatment: water from spring is collected in reservoir from whence it flows to the system by gravity.	Water is pumped with aeration to reservoir and then to system. Aeration of water is carried out to remove iron.		
Storage capacity (thousand gallons).....	Concrete reservoir.....1·5	Ground reservoir.....50		
Consumption (average in m.g.d.).....	No data—(only 25 services in use at time of survey).	1952		
		0·207		
Industrial use.....	A farming community; one concrete plant; six grain elevators.	No major industrial user. Industrial use in 1952 was only 7,000 gals.		
Remarks.....	System installed in late 1951.	† Dept. of Economic Affairs of Alberta.		
^c Population according to Ninth Census of Canada, 1951.				
Municipality.....	NORMAN WELLS, N.W.T.	PEACE RIVER, ALTA.		
Population served:	1951	1953	1951	
In municipality.....	No data	.....	2,000 (1,672 ^c)	
Outside municipality.....	.....	.....	0	
Total.....	100-150	.....	2,000	
Date(s) of survey.....	December 1954†, February 1955.....	September 1951†, October 3, 1951.....		
Ownership.....	Owned and operated by the Imperial Oil Co. Ltd.	Municipally owned and operated.....		
Source of supply.....	Bosworth Creek.....	Peace River.....		
Treatment.....	Water pumped from behind dam on creek to system with chlorination (sodium hypochlorite). Water heated in winter by being buried alongside steam lines.	River water is pumped to plant on nearby hill, is coagulated with alum, settled, rapid-sand filtered and chlorinated; it then flows by gravity to system.		
Storage capacity (thousand gallons).....	Small dam on creek. Tank reservoir.....1·5	Clear well.....50		
Consumption (average in m.g.d.).....	No data..... (Plant capacity.....700,000 g.p.d.)	1951		
		0·065		
Industrial use.....	Used by Imperial Oil Co. Ltd., for steam generation, etc.	Main users are a tannery, a meat-packing plant, and a flour and feed mill.		
Remarks.....	System installed in 1944. † Data from Dept. of Northern Affairs and National Resources.	System installed in 1950. † Dept. of Economic Affairs of Alberta.		
^c Population according to Ninth Census of Canada, 1951.				

DESCRIPTION OF MUNICIPAL WATER SYSTEMS
(A. Mackenzie River Drainage Basin)—Continued

JASPER, ALTA.	LAC LA BICHE, ALTA.	MERCOAL, ALTA.
1951 1,800† (1,899*)*	1951 905° 0 905	1953 1,200 0 1,200
1,800	1,200	1,200
September 26, 1951.....	September, 1954.....	March 16, 1954.....
Dept. of Northern Affairs and National Resources.	Municipally owned and operated.	Owned and operated by Canadian Collieries, Ltd.
Cabin Lake, 2½ miles distant.	Lac La Biche.	Mercoal Creek.....
Water flows by gravity from Cabin Lake to two reservoirs, is then chlorinated and flows to system by gravity.	Water pumped with chlorination direct from lake to system.	No treatment; water flows by gravity to system from reservoir.
Cabin Lake..... 145,940 Two reservoirs (concrete)..... 600 total	None.....	Ground reservoir..... 50
1951 1·0	1954 30,000 g.p.d.	No data.....
Major area activity is tourist trade. (Jasper National Park).	No major industrial user.....	A coal mining community.....
System installed prior to 1940. * In summer, population rises to 5,000. † Dept. of Economic Affairs of Alberta.		
RYCROFT, ALTA.	SPIRIT RIVER, ALTA.	WESTLOCK, ALTA.
1951 372° 0 372	1953 428 0 428	1951 1,111° 0 1,111
1953*.....	1951 553° 0 553	1952 1,400 0 1,400
Municipally owned and operated.....	September 1951†; February 26, 1954.....	1950†; July 30, 1952.....
Small creek.....	Municipally owned and operated.....	Municipally owned and operated.....
Chlorination; water is hauled by truck to consumers.	Wells and spring run-off, 1½ miles distant.....	Six wells, 240 ft. deep.....
No data.....	Water is pumped to the system with chlorination.	No treatment; water pumped to elevated tank and system.
No data.....	One dugout reservoir.....	One elevated tank..... 50
No data.....	1953 0·16	1951 0·040
No data.....	A lumbering and farming community; no major industrial user.	A farming community.....
* Data supplied by the Dept. of Health of Alberta.	System installed in 1952-53. † Dept. of Economic Affairs of Alberta.	System installed in 1947 and extended in 1951-52. † Dept. of Economic Affairs of Alberta.

DESCRIPTION OF MUNICIPAL WATER SYSTEMS

(A. Mackenzie River Drainage Basin)—Concluded

	YELLOWKNIFE, N.W.T.	
	1951	1953
Municipality.....		
Population served:		
In municipality.....	2,724 ^o	.....
Outside municipality.....	0	.....
Total.....	2,724	2,000 ^{††}
Date(s) of survey.....	December 1954†.....	
Ownership.....	Municipally owned and operated.....	
Source of supply.....	Great Slave Lake, Yellowknife Bay.....	
Treatment.....	Water pumped with chlorination (sodium hypochlorite) to system which is buried in ground; water heated and recirculated in winter.	
Storage capacity (thousand gallons).....	Inside tank..... 5,000 gals.	
Consumption (average in m.g.d.).....	1953	
Industrial use.....	70,000 g.p.d. (summer)*.....	
Remarks.....	No major industrial user.	

^o Population according to Ninth Census of Canada, 1951.

System installed in 1948.
 † Data from Dept. of Northern Affairs and
 Nat. Resources.
 †† Average; winter population is less than summer
 population.
 * In winter 300,000 g.p.d. are pumped when
 recirculating water.

DESCRIPTION OF MUNICIPAL WATER SYSTEMS
(B. Yukon River Drainage Basin)

Municipality.....	DAWSON, Y.T.		WHITEHORSE, Y.T.			
	1951	1954	1951	1954		
Population served:						
In municipality.....	783°	500				
Outside municipality.....	.....	0			
Total.....	.....	500			
Date(s) of survey.....	1954		December 1954; December 1955.....			
Ownership.....	Privately owned and operated by Dawson City Water and Power Co. Ltd.		Owned and operated by Dept. of National Defence (Army).			
Source of supply.....	Wells.....		McIntyre Creek; in late 1955 another small creek diverted into McIntyre Creek near intake.			
Treatment.....	No treatment; pumped to system.....		Water pumped to storage tanks and system with chlorination (sodium hypochlorite). Plant capacity 3 m.g.d.			
Storage capacity (thousand gallons).....	None.....		Underground reservoirs....., 50 and 150 Two ground level reservoirs....., 208			
Consumption (average in m.g.d.).....	1954		1954			
	No data		1·0 {Max. 1·6 (Min. 0·8)			
Industrial use.....	No major industrial user.....		No industrial user; military camp is the largest user.			
Remarks.....						
° Population according to Ninth Census of Canada, 1951.						

TABLE IV
Chemical Analyses of Municipal Water Supplies
A. MACKENZIE RIVER DRAINAGE BASIN
(*In parts per million*)

Municipality.....	AKLAVIK, N.W.T.	NEW AKLAVIK, N.W.T.	ATHABASCA, ALTA.	BARRHEAD, ALTA.
Source(s).....	MUSKEG POND North lot 64	MACKENZIE RIVER	ATHABASCA RIVER	TWO WELLS
	Raw and finished water	—	Raw and finished water	Raw and finished water
Sampling point.....	—	—	Town tap	Town tap
1 Date of collection.....	Dec. 4/49	June 13/56*	**	Oct. 2/51
2 Storage period (days).....	About 30	26.57	.....	14.34
3 Sampling temperature, °C.....				11.1
4 Test temperature, °C.....	21.0	23.5	.....	22.5 (12)
5 pH.....	7.2	7.5	.....	7.9 (7.9)
6 Colour.....	45	50	30	2 (15)
7 Turbidity.....	6	20	.....	7 (5)
8 Suspended matter, dried at 105°C.....		9.8	.....	2.8
9 Suspended matter, ignited at 550°C.....		4.9	.....	1.5
10 Residue on evaporation, dried at 105°C.....	306	107	220	175
11 Ignition loss at 550°C.....	79.4	24.0	40	18.8
12 Specific conductance (micromhos at 25°C).....	456	167	.....	281
13 Calcium (Ca).....	55.2	20.9	38	40.5
14 Magnesium (Mg).....	25.8	5.8	16	10.3
15 Iron (Fe) Total.....	0.46	.....	2.2	0.1
16 Dissolved.....		0.40	.....	0.07
17 Sodium (Na).....	7.1	2.3	{ 1 as Na	5.5
18 Potassium (K).....	3.2	2.0		1.0
19 Carbonate (CO ₃).....	0	0	0	0 (0)
20 Bicarbonate (HCO ₃).....	242	73.0	116	151 (142)
21 Sulphate (SO ₄).....	43.3	13.2	64	32.4
22 Chloride (Cl).....	3.7	3.7	2	0.8
23 Fluoride (F).....		0.00	.....	0.1
24 Nitrate (NO ₃).....		4.8	0	0
25 Silica (SiO ₂), Colorimetric.....	6.0	2.2	2	3.8 (4)
26 Carbonate hardness, as CaCO ₃	198	59.9	95	124 (116)
27 Non-carbonate hardness, as CaCO ₃	45.9	16.1	67	19.4 (33.8)
28 Total hardness, as CaCO ₃	244	76.0	162	143 (150)
29 Sum of constituents.....	264	92.3	182	168
30 Saturation index.....	-0.3	+0.8	.....	+0.1
Remarks			*See also Station No. 16A.	**See also Athabasca River at Station No. 9, Table III.

TABLE IV—Continued
 Chemical Analyses of Municipal Water Supplies
 A. MACKENZIE RIVER DRAINAGE BASIN
(In parts per million)

BEAVERLODGE, ALTA.	DAWSON CREEK, B.C.					EDSON, ALTA.		FAIRVIEW, ALTA.	
	WELLS					WELLS		SMALL LAKES	
Raw and finished water	Raw water	KISKATINAW RIVER				Raw and finished water	Raw and finished water		Raw and finished water
		Finished water		Raw and finished water			Raw and finished water		
TOWN TAP	—	TOWN TAP		TOWN TAP		TOWN TAP		TOWN TAP	
†		Feb. 12/51	Oct. 5/51	Aug. 5/52	†	Sept. 25/51	†	Aug. 6/52	1
		9.31	11.34	9.14		9.34		13.15	2
		4.4	13.3	14.4 (58)		11.1		13.9	3
		22.0	22.3 (11)	27.7 (16)		23.3		24.7 (22)	4
		7.8	7.7	8.2 (8.2)		7.8		7.1 (7.1)	5
		10	10	5 (25)		1		100 (125)	6
		3	5 (clear)	10 (5)		0.4		2 (<5)	7
	See			7.4					8
	Station No. 47			3.0					9
1414	Table II, page 40	370	361	251	476	442	365	289	10
		36.0	44.4	110		44.0		112	11
		594	385	376		725		393 (385)	12
		90.7	90.7	58.2	56.9	60.1	51.1	52.6	13
		24.8	23.8	14.3	14.2	28.6	20.5	17.6	14
				0.4					15
	trace	0.23		0.14		0.02	trace	0.61	16
	{ 2.5 as Na	12.4 1.0	5.4 1.2	5.2 1.0	{ 85.2 as Na	98.0 2.8	{ 2 as Na	4.5 16.0	17 18
0	0	0.0	4.8 (0)	5.3 (0.7)		0	0	0 (0)	19
1098	476	397	222 (234)	204 (204)		478	158	178 (190)	20
200	17.3	17.8	30.9	29.3	35.2	25.7	97	44.2	21
9	trace	0.0	2.5 (2.1)	2.6	6.1	2.8	2	6.6	22
		0.0		0.2		0.1			23
	trace	0.0	0	0.2	0	0.1	0	1.0	24
	7.2	6.3	2.8 (2)	3.6		8.5	3	8.9	25
60	328	324	190 (192)	176 (178)		211.5	130	146 (156)	26
0	0	0	14.0 (14.8)	24.3 (26.5)		0	130	36.2 (31.2)	27
60	328	324	204 (207)	200 (205)	267	211.5	260	182 (187)	28
	377	348	230	220		443		234.5	29
	+0.9	+0.7	+0.8	+0.9		+0.8		-0.4	30

Remarks: †1951 Report of Dept. of Economic Affairs of Alberta.

TABLE IV—Continued
Chemical Analyses of Municipal Water Supplies
A. MACKENZIE RIVER DRAINAGE BASIN
(*In parts per million*)

No.	Municipality.....	FORT SMITH, N.W.T.						
		SLAVE RIVER*						
Sampling point	Raw water							
	From river direct					From sump well alongside river*		
1	Date of collection.....	**Nov. 13/48	Oct. 1/49	July 7/50	Oct. 23/51	July 7/50	April 7/51	July 9/51
2	Storage period (days).....		123	17	18	17	131:132	38:44
3	Sampling temperature, °C.....				0		1·1	17·2
4	Test temperature, °C.....		19·0		23·3		24·0	24·0
5	pH.....	8·35	9·0		7·7		8·2	7·5
6	Colour.....	25	10		10		10	25
7	Turbidity.....		20		65		1	25
8	Suspended matter, dried at 105°C.....	16	70		81			119
9	Suspended matter, ignited at 550°C.....	12	62		73			106
10	Residue on evaporation, dried at 105°C.....	140	147		125		1,198	147
11	Ignition loss at 550°C.....	16·0	18·0		12·8		257	58·4
12	Specific conductance (micromhos at 25°C).....	See Station	240		214		1,615	234
13	Calcium (Ca).....	No. 11,	26·1	29·4			123	31·1
14	Magnesium (Mg).....	Table II,	6·2	5·8		6·3		5·8
15	Iron (Fe) Total.....	page 20.						
16	Dissolved.....		0·7	0·02		0·09		0·05
17	Sodium (Na).....		8·0	11·2		8·5		183
18	Potassium (K).....	{ as Na	0·9		1·4		3·0	1·7
19	Carbonate (CO ₃).....	44·4	16·8	2·4	0	0	1·2	0
20	Bicarbonate (HCO ₃).....		72·7	102·5	86·9	122	172	114
21	Sulphate (SO ₄).....	16·9	23·9	23·7	18·0	64·3	133	17·0
22	Chloride (Cl).....	12·0	10·9	4·0	10·9	193	375	4·3
23	Fluoride (F).....		0·15		0·30		0·10	0·30
24	Nitrate (NO ₃).....	0·0	0·0		0·2		0·0	1·2
25	Silica (SiO ₂) Colorimetric.....	6·4	4·4		4·3		9·8	3·8
26	Carbonate hardness, as CaCO ₃	73·9	87·6	88·0	71·2	100	141	93·0
27	Non-carbonate hardness, as CaCO ₃	16·7	9·7	10·0	18·1	126	268	8·5
28	Total hardness, as CaCO ₃	90·6	93·7	98·0	89·3	226	408	102
29	Sum of constituents.....		141		118		933	127
30	Saturation index.....		+0·9		-0·5		+0·9	-0·5
REMARKS:		**Not a Dept'l. analysis.					Low flow.	Very low river flow.
* Slave River water usually mixed at sump well with ground water.								Medium river flow.

TABLE IV—Continued
Chemical Analyses of Municipal Water Supplies
A. MACKENZIE RIVER DRAINAGE BASIN
(In parts per million)

FORT SMITH, N.W.T.													No.
SLAVE RIVER*													No.
Raw water			Finished water										No.
For sump well alongside river	After filters	Plant tap	Plant tap†										
Aug. 19/51	Oct. 23/51	Feb. 13/51	July 10/51	Aug. 19/51	Oct. 24/51	Nov. 30/51	Dec./51	Jan. 11/52	Mar. 31/52	Apr. 30/52	June 1/52		1
23.24	18	7.7	37.38	23.24	15.40	368.400	338.370	308.346	259.294	229.264	198.233		2
19.4	1.1	2.8	12.8	.....	1.7	3.3	4.4	4.4	0	0.6	12.2		3
23.8	23.3	25.0	24.0	23.8	23.3	21.9	19.8	19.8	19.8	19.8	19.8		4
7.1	7.6	7.1	7.8	7.3	7.6	7.6	7.5	7.5	7.7	7.3	7.4		5
30	8	5	5	2	5	slight	0	0	0	0	0		6
30	75	7	1	0.7	2	slight	0	slight	slight	considerable	slight		7
83	119	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		8
69	109	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		9
176	171	.....	774	440	.....	.....	.....	.....	.....	.....	.....		10
63.6	25.2	.....	163	75.0	.....	.....	.....	.....	.....	.....	.....		11
225	280	2,330	1,112	684	1,014	835	1,234	1,557	496.4	852	501		12
31.4	29.9	179	73.4	62.3	76.2	66.2	92.3	118	49.9	63.4	43.6		13
7.3	6.9	27.0	22.4	11.5	13.0	13.4	17.0	21.3	11.6	11.4	7.4		14
.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....		15
0.90	0.14	.....	0.03	0.06	.....	.....	.....	.....	.....	.....	.....		16
4.8	16.2	284	109	57.0	125	79.7	128	162	34.0	91.0	41.0		17
0.6	1.4	29.2	2.6	0.5	0.3	2.0	2.4	2.0	1.0	6.0	0.8		18
0	0	0	0	0	0	0	0	0	0	0	0		19
114	89.1	212	132	115	127	120	128	164	160	108	82.0		20
17.2	23.5	186	92.6	68.3	104	87.2	114	147	61.7	128	69.1		21
6.0	27.6	573	230	119	207	151	259	323	46.0	139	72.0		22
.....	0.30	0.20	0.10	0.15	.....	.....	.....	0.8	1.2	0.8	0.6		23
2.4	0.2	0.2	0.0	.....	0.1	.....	.....	.....	.....	.....	.....		24
3.3	3.6	6.3	6.8	4.1	4.2	.....	.....	.....	.....	.....	.....		25
93.6	73.0	174	108	94.0	104	98	103	134	131	88.2	67.2		26
14.8	30.0	383	187	109	140	122	197	249	41.6	117	72.1		27
108	103	557	275	203	244	220	300	383	172	205	139		28
130	154	1,389	602	379	529	458	674	855	284	493	275		29
-0.9	-0.5	+0.1	+0.2	-0.4	0	-0.2	-0.1	+0.1	+0.1	-0.4	-0.7		30
Medium river flow.	Low river flow.	Medium river flow.	.....	.....	.....	.....	.....	.....	.....	.....	.....
† No chlorine being used.													

TABLE IV—Continued
 Chemical Analyses of Municipal Water Supplies
 A. MACKENZIE RIVER DRAINAGE BASIN
(In parts per million)

Municipality.....		
Source(s).....	MUSKWA RIVER	
Sampling point.....	Raw and finished water	
No.		At tap
1	Date of collection.....	Feb. 1955*
2	Storage period (days).....	27·35
3	Sampling temperature, °C.....	1·7
4	Test temperature, °C.....	24·4
5	pH.....	room 7·4
6	Colour.....	0
7	Turbidity.....	10
8	Suspended matter, dried at 105°C.....	trace
9	Suspended matter, ignited at 550°C.....	4·9
10	Residue on evaporation, dried at 105°C.....	281
11	Ignition loss at 550°C.....	314
12	Specific conductance (micromhos at 25°C).....	36·8
13	Calcium (Ca).....	515
14	Magnesium (Mg).....	66·2
15	Iron (Fe) Total.....	17·4
16	Dissolved.....	0·08
17	Sodium (Na).....	15·0
18	Potassium (K).....	1·0
19	Carbonate (CO ₃).....	0
20	Bicarbonate (HCO ₃).....	0
21	Sulphate (SO ₄).....	246
22	Chloride (Cl).....	68·5
23	Fluoride (F).....	4
24	Nitrate (NO ₃).....	1·3
25	Silica (SiO ₂) Colorimetric.....	0·00
26	Carbonate hardness, as CaCO ₃	0·2
27	Non-carbonate hardness, as CaCO ₃	4·8
28	Total hardness, as CaCO ₃	170
29	Sum of constituents.....	64·0
30	Saturation index.....	234
31	Copper (Cu).....	337
32	Aluminum (Al).....	296
33	Manganese (Mn).....	+0·7
	REMARKS:	0·0
	† Army Camp.	0·06
		0·01
		*Data supplied by water-treatment firm.

TABLE IV—Continued
Chemical Analyses of Municipal Water Supplies
A. MACKENZIE RIVER DRAINAGE BASIN
(In parts per million)

FORT NELSON, B.C.†

WELLS						
Raw water		Finished water**				
At wells		At Central Heating Plant tap				
Jan. 1956	April 25/56	Sept. 22/55	Dec. 15/55	Jan./56	April 25/56	June 4/56
0·6	9·15	7·54	.....	.....	9·15	29·64
24·1	24·1	22·3	21·8	24·2	24·1	23·3
7·3	6·9	8·2	8·3	8·1	8·3	8·0
5	10	5	10	5	10	5
high Δ	very high Δ	.....	.....	1	.....	0·9
140	.....	.....	.....	.....	.....	.....
1,295	.....	.....	.....	819	.....	754
86	.....	.....	.....	66·0	.....	80·8
1,640	1,457	1,006	1,142	1,039	1,119	943·9
332	286	184	194	164	180	132
50·4	44·9	22·1	40·6	41·0	51·2	40·5
43	.....	.....	.....	.....	.....	0·26
0·09	.....	0·05	.....	0·08	.....	0·18
8·3	7·0	7·3	8·3	8·3	7·0	7·0
3·0	2·7	3·0	3·2	30	2·7	2·7
0	0	0	0	0	0	0
684	615	145	208	132	263	130
472	372	445	488	475	376	381
0·7	0·4	0·2	1·0	0·7	0·6	0·8
0·00	.....	0·10	.....	0·15	.....	0·00
1·2	2·4	1·2	1·6	1·6	3·2	4·0
11	11	7·7	5·2	4·1	6·7	3·9
561	505	119	170	108	216	106
475	393	130	481	471	442	390
1,036	898	549	651	579	658	496
1,217	1,029	742	844	763	757	636
+1·0	+0·4	+1·0	+1·2	+0·8	+1·4	+0·6
0·0	.....	0·0	.....	0·0	.....	0·0
0·0	.....	0·03	.....	0·28	.....	0·25
1·1	high	0·02	.....	0·05	.....	0·04

△Precipitated iron.

**Lime-softened.

TABLE IV—Continued
Chemical Analyses of Municipal Water Supplies
A. MACKENZIE RIVER DRAINAGE BASIN
(In parts per million)

No.	Municipality.....	GRANDE PRAIRIE, ALTA.				GRIMSHAW, ALTA.	
		BEAR CREEK (RIVER)				SPRING	
		Raw water	Finished water			Raw and finished water	
Sampling point	—	—	Town tap			—	Town tap
1 Date of collection.....	Oct. 4/51	Oct. 4/51	Nov. 16/53†	Jan. 11/54†	**	Aug. 6/52	
2 Storage period (days).....	12.32	12.32	.....	.....	.....	13.19	
3 Sampling temperature, °C.....	6.7	11.1	.....	.....	.....	11.1	
4 Test temperature, °C.....	22.3 (15.0)	.....	.....	.....	.....	24.7	
5 pH.....	7.7 (8.0)	7.3 (7.0)	7.8	7.0	.....	7.4 (7.0)	
6 Colour.....	25 (50)	2 (15)	.....	.....	.....	5 (15)	
7 Turbidity.....	4 (15)	3	2	2	.....	10 (5)	
8 Suspended matter, dried at 105 °C.....	19	.....	.....	.....	.....	28	
9 Suspended matter, ignited at 550°C.....	13	.....	.....	.....	.....	23	
10 Residue on evaporation, dried at 105°C.....	205	188	250	280	414	442	
11 Ignition loss at 550°C.....	60.0	69.2	.....	.....	86	62.6	
12 Specific conductance (micromhos at 25°C).....	255	280	.....	.....	.....	653 (660)	
13 Calcium (Ca).....	24.8	25.5	40	48	.....	77.1	
14 Magnesium (Mg).....	7.0	6.8	9.7	9.8	.....	26.2	
15 Iron (Fe) Total.....	.....	.....	0.2	0.1	.....	3.0	
16 Dissolved.....	0.28	0.08	.....	.....	.....	0.04	
17 Sodium (Na).....	15.0	15.0	.....	.....	.....	18.4	
18 Potassium (K).....	7.3	7.3	.....	.....	.....	10.2	
19 Carbonate (CO ₃).....	0	0 (0)	0	0	0	0	
20 Bicarbonate (HCO ₃).....	102	68.0 (61.0)	122	159	238	266	
21 Sulphate (SO ₄).....	42.8	73.5	63	71	80	124	
22 Chloride (Cl).....	1.3	2.1 (2.0)	1.2	trace	3	6.1	
23 Fluoride (F).....	0.30	0.30	.....	.....	.....	0.25	
24 Nitrate (NO ₃).....	0.8	0.2	.....	.....	0.3	1.4	
25 Silica (SiO ₂), Colorimetric.....	4.2	1.7	5.2	2.2	.....	18	
26 Carbonate hardness, as CaCO ₃	83.6	56.0	100	130	195	218 (217)	
27 Non-carbonate hardness, as CaCO ₃	7.1	32.3	40	30	125	82.5 (98.4)	
28 Total hardness, as CaCO ₃	90.7	88.3	140	160	320	300 (315)	
29 Sum of constituents.....	147	166	.....	.....	.....	413	
30 Saturation index.....	-0.4	-1.0	.....	.....	.....	+0.15	
REMARKS:		.....	Carbon dioxide— 1.8 p.p.m. (field det'n.)	Carbon dioxide— 15.8 p.p.m. (field det'n.)	**Analysis by J. A. Kelso, Provincial Analyst.		
†Data supplied by Alchem Ltd., Burlington, Ontario.							

TABLE IV—Continued
Chemical Analyses of Municipal Water Supplies
A. MACKENZIE RIVER DRAINAGE BASIN
(In parts per million)

HIGH PRAIRIE, ALTA.				JASPER, ALTA.	LAC LA BICHE, ALTA.	
WELL				CABIN LAKE	LAC LA BICHE	
Raw water		Finished water		Raw and finished water	Raw water	Finished water
At well		At reservoir		Town tap	At intake	Town tap
March 3/54	April 27/54	March 3/54	April 27/54	August 26/51	April 9/53	April 9/53
9.29	10	9.29	10	13.33	8.26	8.26
7.2	7.2	6.7	7.8	10.0	1.1	2.2
22.2		22.2		19.2	21.7	21.7
8.0	8.4	7.8		7.6	7.9	8.3
120		110		5	15	10
10		7		3	0.5	0.5
18		6.7				
7.1		3.6				
879		871		103	215	221
161		164		35.0	59.2	70.0
1,123		1,127		155	334	336
36.0	35.5	35.3		19.3	35.4	36.5
20.3	20.6	20.2		7.2	13.5	12.5
	3.8		1.66			
				0.01	0.11	0.09
200		202		3.3	16.0	18.0
7.2		7.2		0.7	4.1	4.3
0	9.1	0		0	0	0
557	529	552		82.7	180	199
3.1		3.3		15.0	15.2	13.4
115		130		1.8	3.7	5.2
				0.10	0.05	0.15
0.0		3.2		0.0	0.6	0.6
8.8		9.3		6.2	2.6	1.7
173	174	171		67.8	144	143
0	0	0		10.0	0	0
173	174	171		77.8	144	143
665		682		94.2	185	191
+0.7		+0.5		-0.8	+0.15	+0.6
Manganese (Mn)=0.0		Mn=0.0				

TABLE IV—Continued
Chemical Analyses of Municipal Water Supplies
A. MACKENZIE RIVER DRAINAGE BASIN
(In parts per million)

No.	Municipality.....	MERCOAL, ALTA.	NORMAN WELLS, N.W.T.			
		MERCOAL CREEK	BOSWORTH CREEK*			
		Raw and finished water	Raw and finished water			
Sampling point.....	Town tap	Town tap, old Canol camp				
1 Date of collection.....	March 16/54	March 17/54	Feb./56	May 4/56	Oct. 11/56	
2 Storage period (days).....	9:51	11:20	.....	20	46:40	
3 Sampling temperature, °C.....		4.4				
4 Test temperature, °C.....	21.7	16.4	24.0	21.4	28.4	
5 pH.....	8.2	8.1	8.5	8.5	8.2	
6 Colour.....	10	5	5	0	20	
7 Turbidity.....	0.9	0	.....	0		
8 Suspended matter, dried at 105°C.....						
9 Suspended matter, ignited at 550°C.....						
10 Residue on evaporation, dried at 105°C.....	194	825	368	621		
11 Ignition loss at 550°C.....	21.4	114	66.4	198		
12 Specific conductance (micromhos at 25°C.).....	326	1,202	554	863	623	
13 Calcium (Ca).....	39.3	137	68.6	105	74.9	
14 Magnesium (Mg).....	8.8	42.7	26.2	37.6	27.4	
15 Iron (Fe) Total.....						
16 Dissolved.....	0.04	0.02	0.02	0.02	0.00	
17 Sodium (Na).....	20.2	58.4	12.6	30.0	16.5	
18 Potassium (K).....	1.6	1.7	1.0	1.5	1.0	
19 Carbonate (CO ₃).....	0	0	6.5	2.4	0	
20 Bicarbonate (HCO ₃).....	214	302	195	258	216	
21 Sulphate (SO ₄).....	5.2	208	110	212	128	
22 Chloride (Cl).....	0.2	69.9	12.6	26.8	16.5	
23 Fluoride (F).....	0.00	0.20	0.10	0.20	0.20	
24 Nitrate (NO ₃).....	0.8	0.4	0.4	1.6	0.8	
25 Silica (SiO ₂), Colorimetric.....	15	5.6	4.8	7.0	4.7	
26 Carbonate hardness, as CaCO ₃	135	248	141	215	177	
27 Non-carbonate hardness, as CaCO ₃	0	270	108	202	122	
28 Total hardness, as CaCO ₃	135	518	279	417	299	
29 Sum of constituents.....	196	763	340	551	376	
30 Saturation index.....	+0.5	+0.1	+1.1	+1.2	+0.0	
REMARKS:		Manganese (Mn)=0	Aluminum (Al)...0.17 Manganese (Mn)...0.01 Copper (Cu)...0.00	0.39 0.0 0.06	0.17 0.0 slight trace	0.19 0.0 trace
*Sometimes a mixture with Mackenzie River water.						

TABLE IV—Continued
Chemical Analyses of Municipal Water Supplies
A. MACKENZIE RIVER DRAINAGE BASIN
(*In parts per million*)

PEACE RIVER, ALTA.		RYCROFT, ALTA.	SPIRIT RIVER, ALTA.	WESTLOCK, ALTA.		YELLOWKNIFE, N.W.T.
PEACE RIVER		—	SPRING RUN-OFF	WELLS		GREAT SLAVE LAKE
Raw water	Finished water	Raw and finished water	Raw and finished water	Raw and finished water		Raw and finished water
Near plant intake	Town tap	Town tap	Town tap	Town tap		—
	†	Oct. 3/51	May 26/54	Mar. 6/54	†	July 30/52
		13.33	16.27	11.61		7.12
		10.0	10.0	4.4		10.6
		22.5 (12)	23.2	21.8		24.3 (24)
	7.9	8.0 (8.2)	7.9	8.6	8.5	8.2 (8.3)
	15	3 (15)	.....	20	40	50
	0	6 (clear)	30	12	0	0.5 (<5)
		1.7	59	7.4		
		0.8	26	4.8		
	173	218	219	454	869	996
	18	21.0	66.8	60.4	64	40.4
		356	269	682		1,509
	34.0	50.3	32.1	40.3	0	4.6
	8	12.0	9.0	26.2	0	0.3
		0.1	0.40	0.53	0.4	
	See	trace	0.05	0.07		0.19
Station No. 56	Table II, page 44	10 as Na	10.3	9.2	64.1	0.06
			0.9	6.8	11.3	2.4
		0	0 (0)	0	0	1.2
		118	178 (173)	133	195	1.5
		35	42.4	31.1	174	21.6
		6	2.6 (2.5)	1.6	3.0	0
			0.00	0.30	0.58	19.8
		0	0.0	2.4	0	5.1
		3	2.7	5.0	3.6	1.8
		97	146 (142)	109	176	0.10
		23	28.9 (32.6)	8.4	32.8	24.2
		120	175 (175)	117	208	0
			209	184	429	12.7
			+0.4	0	807	947
				+0.9		+0.25
		†Dept. of Economic Affairs of Alberta, (1951 report).	Manganese (Mn)=0.18	Manganese (Mn)=0.0	†Dept. of Economic Affairs of Alberta, (1950 report).	See also Station No. 13, Table II, page 22.

TABLE IV—Concluded
Chemical Analyses of Municipal Water Supplies
B. YUKON RIVER DRAINAGE BASIN IN CANADA
(In parts per million)

Municipality.....	DAWSON, Y.T.	WHITEHORSE, Y.T.						
Source(s).....	WELLS	MCINTYRE CREEK†				MCINTYRE CREEK mixed with small tributary creek		
	Raw and finished water	Raw and finished water				Raw and finished water		
Sampling point.....	Town tap	Town taps and taps in Army Camp				Tap in Central Heating Plant, at Army Camp		
Date of collection.....	June 7/56	Mar. 27/43*	Jan. 1/55	Mar. 9/55	May 5/55	Oct. 12/55	Nov. 30/55	Jan. 3/56
Storage period (days).....	10·20	17	15·42	13·47	12·33	12·21	13·29	12·28
Sampling temperature, °C.....	3·9	.....	17	1·1	2·2	.....	4·4	.....
Test temperature, °C.....	26·4	.....	17·3	20·6	25·4	21·1	23·1	24·6
pH.....	7·9	7·9	8·3	8·0	8·6	8·3	8·3	8·7
Colour.....	10	.....	10	0	10	10	5	5
Turbidity.....	.....	.....	0	0	6	.....	0	0
Suspended matter, dried at 105°C.....	.....	.....	.....	.....	.....	.....	.....	.....
Suspended matter, ignited at 550°C.....	.....	.....	.....	.....	.....	.....	.....	.....
Residue on evaporation, dried at 105°C.....	208	209	198	.....	.....	.....	.....	.....
Ignition loss at 550°C.....	83·2	22·4	15·6	.....	.....	.....	.....	.....
Specific conductance (micromhos at 25°C).....	225	.....	328	353	360	272	261	274
Calcium (Ca).....	28·3	54·8	49·3	50·1	49·5	38·9	37·4	38·8
Magnesium (Mg).....	7·4	13·9	12·5	12·9	13·3	9·3	9·8	11·5
Iron (Fe) Total.....	Dissolved.....	0·0	0	0·05	.....	.....	.....	.....
Aluminum (Al).....	0·05	.....	0·0	0·03	.....	.....	.....	.....
Manganese (Mn).....	0·0	.....	0·0	trace	.....	.....	.....	.....
Sodium (Na).....	2·4	.....	4·7	3·9	3·0	3·2	3·9	4·5
Potassium (K).....	0·5	.....	1·2	1·1	1·5	1·0	1·1	1·1
Carbonate (CO ₂).....	0	0	0	0	6·6	0	0	12·0
Bicarbonate (HCO ₃).....	86·5	229	215	222	210	166	182	151
Sulphate (SO ₄).....	34·4	5·1	8·3	8·0	4·9	9·3	7·3	6·5
Chloride (Cl).....	0·1	1·3	0·2	0·1	0·3	0·3	0·4	0·5
Fluoride (F).....	0·05	.....	.....	0·10	.....	.....	.....	.....
Nitrate (NO ₃).....	1·6	0·6	1·0	0·8	0·8	1·6	2·4	0·8
Silica (SiO ₂), Colorimetric.....	8·2	13	15	17	13	16	16	.....
Carbonate hardness, as CaCO ₃	71·0	18·8	174	178	178	135	133	143
Non-carbonate hardness, as CaCO ₃	30·0	5·7	0	0	0	0	0	0·8
Total hardness, as CaCO ₃	101	194	174	178	178	135	133	144
Sum of constituents.....	126	.....	198	203	196	162	158	211
Saturation index.....	-0·2	.....	+0·7	+0·4	+1·2	+0·5	+0·6	+1·0
Remarks:	Copper (Cu)—trace	*Not a Dept'l. analysis. †See also Station No. 5y, page 54.	Cu—trace	Cu—0·0	.....	Cu—0·0	.....	.....

TABLE V
Municipal Water Supplies Within the Mackenzie and Yukon River Drainage Basins
Summary of data on systems, treatment and population served, 1951

Drainage basins	Number of municipal water systems studied					Sources of water for municipal systems					Treatment of water in municipal systems			Approximate population served ^b with water in 1951					Percentage of total population of basin area served with water in 1951.						
	N.W.T.	Y.T.	B.C.	Alta.	Total		N.W.T.	Y.T.	B.C.	Alta.	Total	None	Chlorination	Additional or other treatment	N.W.T.	Y.T.	B.C.	Alta.	Total	N.W.T.	Y.T.	B.C.	Alta.	Total	
Mackenzie River.....	4	0	1	12(3) ^a	17(3)	Ground					5(1)	5(1)	5		0(1)					5,436	5,436				
						Surface	4		1	7(1)	12(1)	2	5(1)	5	3,850		4,589	10,542	18,981	39	0	33	13.5	17.1	
						Mixed				0(1)	0(1)		0(1)					(905) (553)	(905) (553)						
Yukon River in Canada.....	0	2	0	0	2	Ground		1			1	1				783			783						
						Surface		1			1		1				2,594		2,594		38				38
						Mixed				0															
Total.....	4	2	1	12.3	19.3	Ground		1		5(1)	6(1)	6		0(1)				3,850	3,777	4,589	15,987	27,794			
						Surface	4	1	1	7(1)	13(1)	2	6(1)	5				(2,599)	(2,599)						
						Mixed				0(1)	0(1)		0(1)												

^a Values in brackets refer to additional systems installed in 1952 and 1953.

^b Does not include all military personnel served in the Territories.

^c Values in brackets refer to population served by systems installed in 1952 and 1953.

TABLE VI
Municipal Water Supplies Within the Mackenzie and Yukon River Drainage Basins
Summary of data on municipal water hardness

Drainage basin	Number of municipal systems	Numbers of systems served with waters classed as					Approximate population served ^c in 1951 with waters classed as				Percent population served ^b in 1951 that is served with waters classed as				Weighted average hardness (1951) of waters in				
		Type	Soft	Medium hard	Hard	Very hard	Soft	Medium hard	Hard	Very hard	Soft	Medium hard	Hard	Very hard	N.W.T.	Y.T.	B.C.	Alta.	
			Ground	3		0(1) ^a	3	2,868		(1,141) ^b	2,568								
Mackenzie River.....	17(3) ^a	Surface	1	2	4(1)	4	2,725	2,271	7,072 (905)	6,913	23	9	29	39	102		257	127 (170)	
		Mixed				0(1)				(553)									
		Ground		1					783										
Yukon River in Canada.....	2	Surface									0	23	0	77		160			
		Mixed				1				2,594									
		Ground	3	1	0(1)	3	2,868	783	(1,141)	2,568									
Total.....	19(3)	Surface	1	2	4(1)	4	2,725	2,271	7,072 (905)	6,913	20	11	25.5	43.5					
		Mixed				1(1)				2,594 (553)									

^a Values in brackets refer to additional systems installed in 1952 and 1953.

^b Values in brackets refer to population served by systems installed in 1952 and 1953.

^c Does not include all military personnel in army camps.

DISCUSSION

It is not proposed to discuss in detail all the data recorded in this report, especially the analytical data tabulated in Tables II, III and IV as the interpretation and usefulness of the information varies so widely with reader interest. However, most surface waters in the basins, although not highly mineralized, do contain more dissolved matter than is found in waters from many other areas of Canada, such as the coastal area of British Columbia and the Canadian Shield. This mineralization is essentially carbonate hardness and the waters range generally from medium hard to the lower limit of very hard when classified as follows:

Soft water.....	Below 61 p.p.m. total hardness as CaCO_3
Medium hard water.....	61-120 p.p.m. total hardness as CaCO_3
Hard water.....	121-180 p.p.m. total hardness as CaCO_3
Very hard water.....	Greater than 180 p.p.m. total hardness as CaCO_3

Tables II and III show that those rivers with headwaters in the calcareous Rocky Mountains or northern extensions of them, are generally medium hard in character. In many there is a notable seasonal variation that is probably caused by the rapid run-off from melting mountain snows and glaciers. Some sections of these rivers periodically carry considerable sediment, as indicated by their high turbidity.

Drainage from the east or from the Canadian Shield is not extensive but is generally a softer water, low in mineralization and typical of surface waters found on the Shield. The larger lakes of this region are usually soft and clear unless, like Lesser Slave Lake, they are situated in or fed by drainage from the lowlands or plains region.

Waters of the Yukon system show considerable variation, mainly in carbonate hardness, ranging from soft to hard waters with an estimated average total hardness range of 60 to 90 p.p.m. as CaCO_3 .

Table I and Figure I clearly show the large size and undeveloped nature of the basins covered by this report. These basins together drain about 91 percent of Yukon Territory and about 23 per cent of Northwest Territories, an area almost one-quarter the area of Canada. However only about 151,820 persons inhabit this area, a little over 1 per cent of Canada's population; 87 per cent of them live in the northern parts of British Columbia, Saskatchewan and Alberta, mostly in the Peace River district of Alberta. Of the 25,000 persons living in these river basins in the Territories, only about one-quarter are white, the remainder being Eskimos and Indians.*

Tables II and III and Figure 2 emphasize the incomplete coverage of water quality in these basins. However, it is believed that these studies are sufficient to show the general chemical quality of the river waters at present most important, and to indicate the quality of water in many lakes and rivers nearby which have not yet been studied.

Figure 3 is a graphical presentation of summer water hardness along the Mackenzie River system. Similar plotting of "average" hardness at various points usually shows a higher hardness but the trend is, in general, similar to the values plotted from data obtained from the summer water samples. There is an increase in hardness as the medium hard waters from the Cordilleran region flow through the lowlands and Alberta plateau. Those rivers flowing just north of the North Saskatchewan River basin show similar changes, but the main Mackenzie River system does not maintain or increase hardness; rather there is a decrease in hardness in the Slave and Mackenzie Rivers caused probably by the inflow of softer waters from the Canadian Shield and by the effect of the large soft-water lakes.

Rivers rising in the Cordilleran region such as Liard, Nahanni etc., do not greatly increase the main river hardness. It is not until the harder waters of the far northern rivers, Arctic Red and Peel, enter the flow that significant changes occur, and at its mouth, waters of the Mackenzie River become quite hard. The wide variability, not only in waters from different rivers but from season to season in most rivers, coupled with the limited data available, confuse the interpretation of effects of each on the main river. Rivers such as McLeod and Pembina, rising in the same locale as the North Saskatchewan, do show hardness characteristics similar to the North Saskatchewan but these harder waters are somewhat balanced by the Peace River which, rising in the interior plateau of British Columbia, is in general a softer water throughout its length, even though it does have some southern tributaries with high hardness, viz; Kiskatinaw River.

From the limited data available on the Yukon River system, it appears to increase slightly in hardness as it flows through the interior plateau, probably because of the inflow of harder water (Stewart River) from the eastern mountain ranges. It is assumed that waters of the Bell River and other northern tributaries are similar in quality to those of Arctic Red and Peel Rivers.

* Since survey work was started in these basins, a considerable increase in population has doubtless occurred because of new defence installations. A survey of water quality at a number of these bases is now under way.

Figure 4, the graphical presentation of changing mineralization in the Athabasca River shows relationships which are typical of many other rivers in these basins. The specific conductance (total dissolved solids content) is paralleled almost identically by total hardness, illustrating that the principal dissolved salts are hardness salts. Deviations in this curve are generally due to an increased sodium sulphate content. The variation in mineral content is quite marked with a peak (higher solids and total hardness) in May and an extreme high in December. The curve of river discharge almost mirrors the curve for conductivity, although there is a lag because a rapid drop in flow is not immediately shown by an increased solids content. High discharge is noted in June after a low in May as conductivity increases. The discharge decreases fairly constantly to a low in January when high conductivity is again noted. This indicates that there may be a local discharge in April followed by decreasing flow until melting snow and ice fields in the mountains cause increased flow of a lower mineralized water around June. From then on, flow steadily decreases to a low around December and January. Turbidity follows generally the curve of discharge, being highest in June but never abnormally high.

Figure 5 shows the variability in chemical quality of the Mackenzie River at Fort Simpson. Discharge records at this point were not available. Despite the many tributaries entering the main river, the Mackenzie maintains a surprisingly constant quality, the only major change being a rapid decrease in total mineral matter in late April when, presumably, spring break-up occurs and the river is affected by run-off from melting snow and ice. Once again carbonate hardness is the main mineral constituent, as evidenced from the similarity of the curves for total hardness, conductivity, sum of constituents and non-carbonate hardness.

Figure 6 shows the relationship between flow and mineral content in the large tributary river, Liard River at Watson Lake, Yukon Territory, at a location well upstream within the Cordilleran region. This river shows increasing mineralization with decreasing discharge to a peak in November. The discharge continues low until its rise with the spring run-off in late April and May at which time total mineralization correspondingly decreases. However, during December and January of 1952-53, there was a decided drop in mineralization which was not reflected in increased discharge. This may be due to some local condition of melting ice and snow; for example, flow from harder tributary streams perhaps decreased in proportion to inflow from melting snow, or from a softer tributary stream. The drop may not be common to all years.

Table V, which summarizes some of the data on municipal systems, illustrates again the heavy settlement in the Alberta part of the basin. Although there is a greater municipal use of surface waters than ground waters, this is not as great as would be expected from the ready availability of surface waters. However, the smallness of many of the systems and the necessity for chlorination or treatment for turbidity or colour in the surface waters, is no doubt the major reason for use of ground waters.

Table VI indicates that a large proportion of these ground waters are soft, or at least as soft as the surface waters. Treatment of supplies is generally by chlorination, although a number of surface waters require treatment for turbidity and colour removal and several should be softened for many industrial uses. The population served is small but considering the extent of the area, a relatively large percentage is served, partly because population is centered in a few areas. This table clearly shows the increased hardness of waters in these basins; of 12 surface water systems, 9 are supplied with hard to very hard water, and 68 per cent of the population served receives hard to very hard water. In the Yukon basin the larger system, at Whitehorse, uses a hard water and greatly influences the limited data. However, the weighted average hardness of waters, served in all areas except British Columbia (one system only) is not excessively high.

SUMMARY

The large area of Canada covered by this report is at present of minor industrial importance but does have available adequate supplies of surface waters suitable for most industrial and municipal uses without extensive treatment.

Many waters of the area have not yet been studied but surface water quality in the areas studied varies rather markedly with location and season; in general, these waters are medium hard to hard. Many will require treatment for turbidity during times of high discharge, and others should be softened for certain uses. Available information on ground waters indicates many of these may be more suitable than surface waters for use by smaller communities.

Municipal use and also industrial use of waters in more northern areas of the basins is complicated by the low winter temperatures and the permanently frozen condition of the ground which necessitates location of systems on the surface with heating of the water during the winter months. In other more southern areas the systems must be deeply buried.

It is expected that additional information on water quality within these basins will be obtained, particularly information on trace elements and heavy metals that may be of assistance in locating mineral deposits.

APPENDIX A
Surface Water Sampling Locations

A. Mackenzie River Drainage Basin		PAGE
<i>Station No.</i>		
65	Arctic Red River at Arctic Red River Settlement, N.W.T.....	52
18	Astoria River near Jasper, Alta.....	28
1	Athabasca River at Athabasca Glacier, Columbia Icefield.....	14
2	“ “ at Athabasca Falls, Alta.....	14
3	“ “ at Athabasca, Alta.....	18
4	“ “ near Blue Ridge, Alta.....	16
5	“ “ at Jasper, Alta.....	14
6	“ “ near Snaring, Alta.....	16
7	“ “ near Pedley, Alta.....	16
8	“ “ near Smith, Alta.....	18
9	“ “ at Fort MacMurray, Alta.....	20
52	Bear River near Grande Prairie, Alta.....	42
46	Beaton River near Fort St. John, B.C.....	40
64A	Bosworth Creek at Norman Wells, N.W.T.....	52
56A	Clearwater River at Fort MacMurray, Alta.....	46
24	Embarras River near Weald, Alta.....	30
60	Emile River near Rae, N.W.T.....	48
38	Fawcett River near Smith, Alta.....	36
28	Freeman River near Fort Assiniboine, Alta.....	32
63	Great Bear Lake near Port Radium, N.W.T.....	50
64	Great Bear River near Fort Norman, N.W.T.....	52
12	Great Slave Lake near Hay River Settlement, N.W.T.....	22
12A	Great Slave Lake at Fort Resolution, N.W.T.....	22
12B	Great Slave Lake (McLeod Bay), at Fort Reliance, N.W.T.....	22
13	Great Slave Lake at Yellowknife, N.W.T.....	22
42	Halfway River near Attachie, B.C.....	36
58	Hay River at Hay River Settlement, N.W.T.....	46
47	Kiskatinaw River near Dawson Creek, B.C.....	40
48	Kiskatinaw River near Sweetwater, B.C.....	42
39	Lac La Biche at Lac La Biche, Alta.....	36
62	Liard River at Fort Simpson, N.W.T.....	50
61	Liard River at Watson Lake, Y.T.....	48
35	Lesser Slave Lake at Faust, Alta.....	34
37	Lesser Slave River near Slave Lake, Alta.....	36
54	Little Smoky River near High Prairie, Alta.....	44
30	Lobstick River near Evansburg, Alta.....	32
16	Mackenzie River at Peel Channel, at Aklavik, N.W.T.....	28
16A	“ “ at New Aklavik, N.W.T.....	28
15A	“ “ at Fort Good Hope, N.W.T.....	26
15	“ “ near Fort Norman, N.W.T.....	24
14	“ “ at Fort Simpson, N.W.T.....	24
13A	“ “ at Fort Providence, N.W.T.....	24
20	Maligne River near Jasper, Alta.....	30
23	McLeod River near Cadomin, Alta.....	30
25	McLeod River near Edson, Alta.....	30
27	McLeod River at Whitecourt, Alta.....	30
19	Miette River near Jasper, Alta.....	28
44	Murray River at East Pine, B.C.....	38
57	Notikewin River at Manning, Alta.....	46

APPENDIX A—Concluded
Surface Water Sampling Locations—Concluded

PAGE

Station No.

32	Paddle River at Barrhead, Alta.	34
50	Peace River near Dunvegan, Alta.	42
41	" " above Halfway River junction, near Attachie, B.C.	36
56	" " at Peace River, Alta.	44
45	" " near Taylor, B.C.	38
66	Peel River at Fort McPherson, N.W.T.	52
29	Pembina River at Evansburg, Alta.	32
33	Pembina River at Jarvie, Alta.	34
31	Pembina River near Sangudo, Alta.	32
43	Pine River at East Pine, B.C.	38
49	Pouce Coupé River near Pouce Coupe, B.C.	42
22	Rocky River near Pocahontas, Alta.	30
11	Slave River at Fort Smith, N.W.T.	20
53	Smoky River near Grande Prairie, Alta.	42
59	Snare River (Big Spruce Lake), near Rae, N.W.T.	46
55	Smoky River at Watino, Alta.	44
21	Snaring River near Jasper, Alta.	30
2	Sunwapta River at Sunwapta Falls, Alta.	14
36	Swan River at Kinuso, Alta.	36
51	Wapiti River near Grande Prairie, Alta.	42
34	West Prairie River at High Prairie, Alta.	34
17	Whirlpool River near Athabasca Falls, Alta.	28
26	Wolf River near Edson, Alta.	30
40	Wollaston Lake, Sask.	36

B. Yukon River Drainage Basin

1Y	Mayo River near Mayo, Y.T.	54
5Y	McIntyre Creek near Whitehorse, Y.T.	54
2Y	Stewart River at Mayo, Y.T.	54
3Y	Yukon (Lewes) River at Whitehorse, Y.T.	54
4Y	Yukon River at Dawson, Y.T.	54

E R R A T A

Page 76, delete lines 7 to 15, and substitute:

1	Athabasca Glacier, Columbia Icefield	14
9	Athabasca River at Athabasca, Alta.	18
3	" " at Athabasca Falls, Alta.	14
7	" " near Blue Ridge, Alta.	16
10	" " at Fort MacMurray, Alta.	20
4	" " at Jasper, Alta.	14
6	" " at Pedley, Alta.	16
8	" " near Smith, Alta.	18
5	" " near Snaring, Alta.	16

Page 76, delete lines 8 to 13 (from bottom) and substitute:

15A	Mackenzie River at Fort Good Hope, N.W.T.	28
15	" " near Fort Norman, N.W.T.	26
13A	" " at Fort Providence, N.W.T.	24
14	" " at Fort Simpson, N.W.T.	24
16A	" " at New Aklavik, N.W.T.	28
16	" " at Peel Channel at Aklavik, N.W.T.	28

APPENDIX B

Municipal Water Systems in the Mackenzie River and Yukon River Drainage Basins

—	DATA PAGE	ANALYSIS PAGE
A. Mackenzie River Basin.		
1 Aklavik, N.W.T., (and New Aklavik).....	56	62
2 Athabasca, Alta.....	56	62
3 Barrhead, Alta.....	57	62
4 Beaverlodge, Alta.....	57	63
5 Dawson Creek, B.C.....	57	63
6 Edson, Alta.....	56	63
7 Fairview, Alta.....	56	63
8 Fort Smith, N.W.T.....	56	64
*9 Fort Nelson, B.C.....	56	66
10 Grande Prairie, Alta.....	56	68
11 Grimshaw, Alta.....	58	68
12 High Prairie, Alta.....	58	69
13 Jasper, Alta.....	59	69
14 Lac La Biche, Alta.....	59	69
15 Mercoal, Alta.....	59	70
16 Norman Wells, N.W.T.....	58	70
17 Peace River, Alta.....	58	71
18 Rycroft, Alta.....	59	71
19 Spirit River, Alta.....	59	71
20 Westlock, Alta.....	59	71
21 Yellowknife, N.W.T.....	60	71
B. Yukon River Basin.		
1 Dawson, Y.T.....	61	72
†2 Whitehorse, Y.T.....	61	72

* Military system not included in statistics.

† Also supplies military camp.



